# ENCYCLOPÆDIA BRITANNICA;

OR, A

# DICTIONARY

OF

# ARTS, SCIENCES,

AND

# MISCELLANEOUS LITERATURE;

Conſtructed on a PLAN,

BY WHICH

THE DIFFERENT SCIENCES AND ARTS

Are digeſted into the FORM of Diſtinct

TREATISES OR SYSTEMS,

COMPREHENDING

The HISTORY, THEORY, and PRACTICE, of each,
according to the Lateſt Diſcoveries and Improvements;

AND FULL *EXPLANATIONS* GIVEN OF THE

VARIOUS DETACHED PARTS OF KNOWLEDGE,

WHETHER RELATING TO

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A General HISTORY, *Ancient* and *Modern*, of the different Empires, Kingdoms, and States;

AND

An Account of the LIVES of the moſt Eminent Perſons in every Nation,
from the earlieſt ages down to the preſent times.

*Compiled from the writings of the beſt Authors, in ſeveral languages; the moſt approved Dictionaries, as well of general ſcience as of its particular branches; the Tranſactions, Journals, and Memoirs, of learned Societies, both at home and abroad; the MS. Lectures of Eminent Profeſſors on different ſciences; and a variety of Original Materials, furniſhed by an Extenſive Correſpondence.*

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VOL. XIII. NEH — PA

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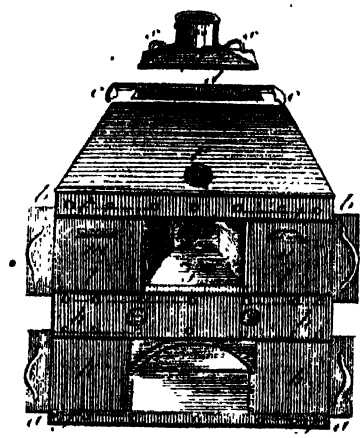
Fig. 1.



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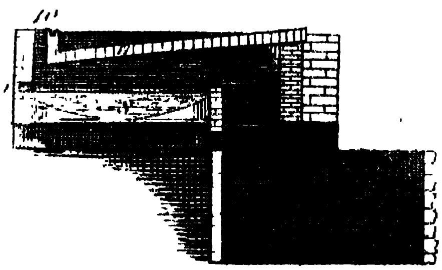

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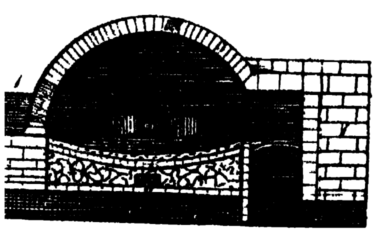
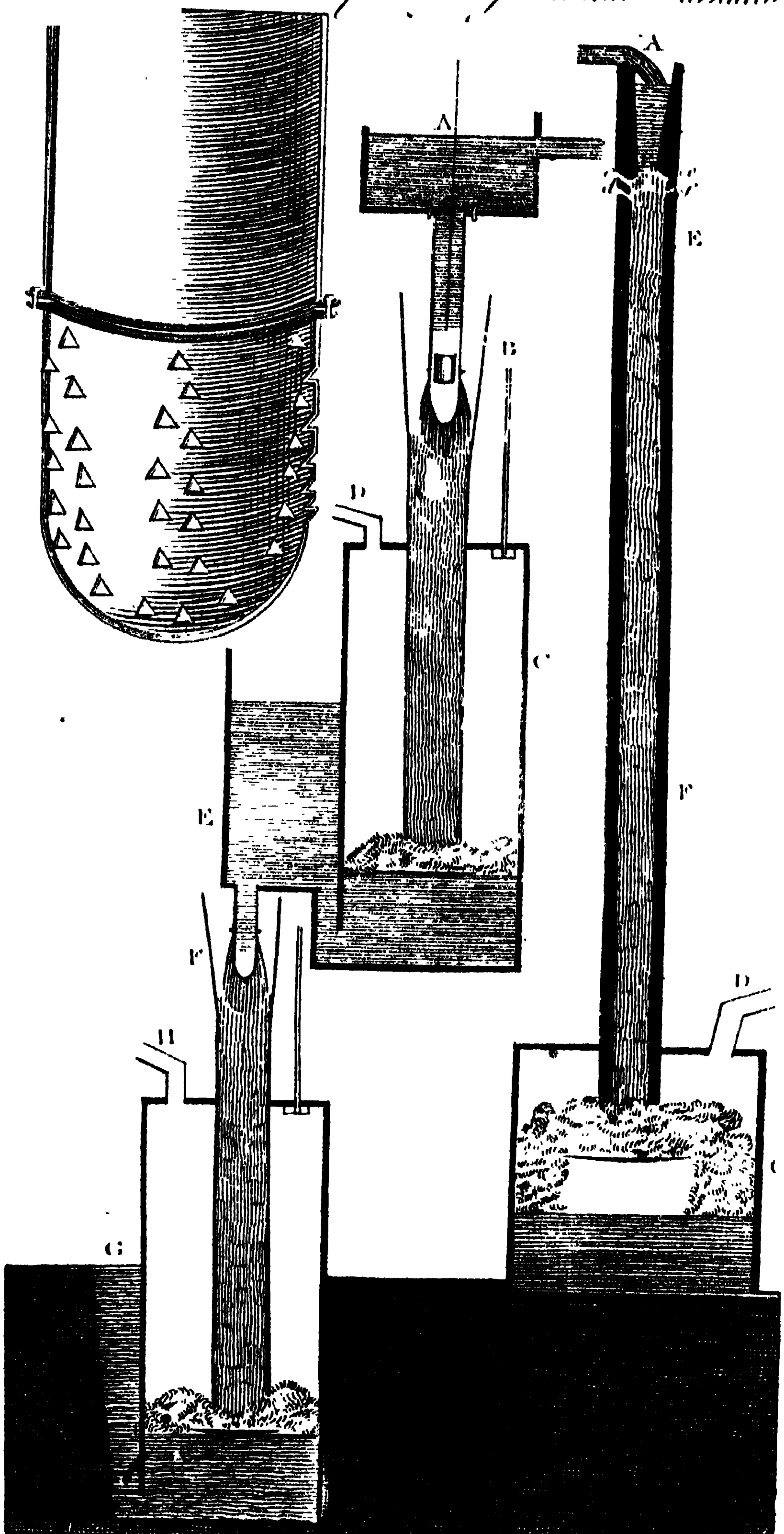


Machines for blowing Air into Furnaces.




A. Bell Prin. Wal. Sculptor fecit

# ENCYCLOPÆDIA BRITANNICA



Nehemiah.

NEHEMIAH, or NEEMIAS, son of Hachaliah, was born at Babylon during the captivity, (Neh. i. 1, 2, &c.) He was, according to some, of the race of the priests, but, according to others, of the tribe of Judah and the royal family. Those who maintain the first opinion, support it by a passage in Ezra, (x. 10.) where he is called a priest; but those who believe that he was of the race of the kings of Judah, say, 1st, That Nehemiah having governed the republic of the Jews for a considerable time, there is great probability he was of that tribe of which the kings always were. 2dly, Nehemiah mentions his brethren Hanani, and some other Jews, who coming to Babylon during the captivity, acquainted him with the sad condition of their country. 3dly, The office of cup-bearer to the king of Persia, to which Nehemiah was promoted, is a further proof that he was of an illustrious family. 4thly, He excuses himself from entering into the inner part of the temple, probably because he was only a laic, (Neh. vi. 11.) "Should such a man as I flee? And who is there that, being as I am, would go into the temple to save his life?"

The Scripture (Ezra ii. 63. Nehem. vii. 65.) calls him תרשתא *tirshatha*, that is to say, "cup-bearer;" for he had this employment at the court of Artaxerxes Longimanus. He had an exceeding great tenderness for the country of his fathers, though he had never seen it; and one day, as some Jews newly come from Jerusalem acquainted him with the miserable estate of that city, that its walls were beat down, its gates burnt, and the Jews were become a reproach among all nations; he was sensibly affected with this relation; he fasted, prayed, and humbled himself before the Lord, that he would be favourable to the design he had then conceived of asking the king's permission to rebuild Jerusalem. The course of his attendance at court being come, he presented the cup to the king according to custom; but with a countenance sad and dejected; which the king observing, entertained some suspicion, as if he might have had some bad design; but Nehemiah (ii.) discovering the occasion of his disquiet, Artaxerxes gave him leave to go to Jerusalem, and repair its walls and gates: but, however, upon this condition, that he should return to court at a time appointed. Letters were made out, directed to the governors beyond the Euphrates, with orders to furnish Nehemiah with timbers necessary for covering the towers and gates of the city, and the house designed for Nehemiah himself, who was now appointed governor of Judea, in the year of the world 3350.

Nehemiah.

Nehemiah being arrived at Jerusalem with the king's commission, went round the city; and having viewed the condition of the walls, assembled the chief of the people, produced his commission, and exhorted them to undertake the reparation of the gates and walls of the city. He found every person ready to obey him; whereupon he immediately began the work. The enemies of the Jews, observing these works in such forwardness, made use of all the means in their power to deter Nehemiah from this undertaking, and made several attempts to surprise him; but finding that their designs were discovered, and that the Jews kept upon their guard, they had recourse to craft and stratagem, endeavouring to draw him into an ambuscade in the fields, where they pretended they would finish the dispute at an amicable conference: but Nehemiah gave them to understand, that the work he had begun required his personal attendance; and therefore he could not come to them. He sent the same answer to four several messages that they sent one after another on the same subject, (*Id.* iv. and vi.)

Sanballat, the chief of the enemies of the Jews, together with his associates, wrote word, that a report was spread that the Jews were building the walls of Jerusalem only with a design to make it a place of strength, to support them in an intended revolt; that it was said also that Nehemiah had suborned false prophets to favour his designs, and to encourage the people to choose him king; and to stop the course of these rumours, he advised him to come to him, that they might confer together, and take such resolutions as should be found convenient. Nehemiah gave himself no trouble on this account, but returned for answer, that all those accusations were false and made at random. About the same time he discovered, that a false prophet, called *Shemaiah*, had been corrupted by his enemies, and that some of the chief of the city were secretly in confederacy with them. Yet all this did not discourage him: he went on with his work, and happily completed it in two and fifty days after it had been begun.

Then he made a dedication of the walls, of the towers, and of the gates of Jerusalem, with the solemnity and magnificence that such a work required. He separated the priests, the Levites, and the princes of the people, into two companies, one of which walked to the south and the other to the north, on the top of the walls. These two companies were to meet at the temple. The procession was accompanied with music both vocal and instrumental: and when they were all come to the temple, they there read the law,

Nehemiah. offered sacrifices, and made great rejoicings. And as the feast of tabernacles happened at the same time, it was celebrated with great solemnity, (*Id.* viii.) Nehemiah observing that the compass of the city was too large for its inhabitants, he ordered that the chief of the nation should fix their dwelling in the city; and caused them to draw lots, by which a tenth part of the whole people of Judah were to dwell at Jerusalem, (*Id.* xi.) Then he applied himself to the reformation of such abuses as had crept into the administration of the public affairs. He curbed the inhumanity of the great ones, who held in a state of slavery the sons and daughters of those who were poor or unfortunate, keeping their lands in possession, which these poor people had been obliged either to mortgage or to sell to the rich. Another abuse there was, which Ezra had in vain attempted to redress, that they had contracted marriages with strange and idolatrous women. Nehemiah undertook to dissolve these marriages, succeeded in it, and sent away all such women as had been taken against the express command of the law, (*Id.* ix.) Having likewise observed, that the priests and Levites were obliged to take refuge wherever they could, and so the ministry of the temple was not attended or performed with that decency it ought, because they did not receive the revenues that the law had appointed for their subsistence; he obliged the people punctually to pay the ministers of the Lord what was due to them, and enjoined the priests and Levites duly to attend on their respective duties, and to discharge their functions, (*Id.* xiii. 10, 11, &c.) He enforced the observation of the sabbath, which had been much neglected at Jerusalem, and would not permit strangers to come in to buy and sell, but kept the gates of the city shut all that day. And, to perpetuate as much as was possible these good regulations which he had newly established, he engaged the chief men of the nation solemnly to renew the covenant with the Lord. This ceremony was performed in the temple, and an instrument was drawn up, which was signed by the principal men, both priests and people, (*Id.* ix. x.) in the year of the world 3551.

We read in the books of Maccabees, (2 Macc. i. 19, 20, 21, &c.) that Nehemiah sent to search for the holy fire, which before the captivity of Babylon the priests had hid in a dry and deep pit; but not finding any fire there, but instead thereof a thick and muddy water, he sprinkled this upon the altar; whereupon the wood which had been sprinkled with this water took fire presently as soon as the sun began to appear. Which miracle coming to the knowledge of the king of Persia, he caused the place to be encompassed with walls where the fire had been hid, and granted great favours and privileges to the priests. It is recorded in the same books, (2 Macc. ii. 13, 14.) that Nehemiah erected a library, wherein he placed whatever he could find, either of the books of the prophets, of David, or of such princes as had made presents to the temple. Lastly, He returned to Babylon (*Id.* v. 14. and xiii. 6.) according to the promise he had made to King Artaxerxes, about the thirty second year of this prince, in the year 3563. From thence he returned again to Jerusalem, where he died in peace, about the year 3580, having governed the people of Judah for about thirty years.

The book which in the English Bible, as also in the Hebrew, has the name of *Nehemiah*, in the Latin Bible is called the book of *Esdras*; and it must be confessed, that though this author speaks in the first person, and though at first reading one would think that he had writ it day by day as the transactions occurred, yet there are some things in this book which could not have been written by Nehemiah himself; for example, memorials are quoted wherein were registered the names of the priests in the time of Jonathan the son of Eliashib, and even to the times of the high priest Jaddus, who met Alexander the Great. These therefore must have been added afterwards. Nehemiah — Neius.

It may well be questioned, whether this Nehemiah be the same that is mentioned in Ezra, (ii. 2. and Neh. vii. 7.) as one that returned from the Babylonish captivity under Zerubbabel; since from the first year of Cyrus to the twentieth of Artaxerxes Longimanus, there are no less than ninety-two years intervening; so that Nehemiah must at this time have been a very old man, upon the lowest computation an hundred, consequently utterly incapable of being the king's cup-bearer, of taking a journey from Shushan to Jerusalem, and of behaving there with all the courage and activity that is recorded of him. Upon this presumption, therefore, we may conclude that this was a different person, though of the same name, and that Tirshatha (the other name by which he is called, Ezra ii. 63. and Neh. vii. 65.) denotes the title of his office, and both in the Persian and Chaldean tongues was the general name given to the king's deputies and governors.

NEHOW, one of the Sandwich islands, discovered by Captain Cook in his last voyage to the Pacific ocean: they are eleven in number, and are situated from 18° 44′ to 22° 15′ N. Lat. and from 154° 56′ to 160° 24′ W. Long. They are not very particularly described in any account that has hitherto appeared.

NEIGHBOUR, 1. One who dwells or is seated near to another (2 Kings iv. 3.) 2. Every man to whom we have an opportunity of doing good (Matt. xxii. 39.) 3. A fellow labourer of one and the same people (Act. vii. 27.) 4. A friend (Job xvi. 21.) At the time of our Saviour, the Pharisees had restrained the word neighbour to signify those of their own nation only, or their own friends; being of opinion that to hate their enemy was not forbidden by their law. But our Saviour informed them, that the whole world were their neighbours; that they ought not to do to another what they would not have done to themselves; and that this charity ought to be extended even to their enemies (Matt. v. 43. Luke x. 29, &c.)

NEISSE, a handsome town of Silesia in Germany, and the residence of the bishop of Breslaw, who has a magnificent palace here. The air is very wholesome, and provisions are cheap; the inhabitants carry on a great trade in wine and linen. This place suffered greatly by an inundation and fire in 1729. It was taken by the Prussians in 1741, who augmented the fortifications after the peace in 1742, and built a citadel to which they gave the name of *Prussia*. It is seated on a river of the same name, in E. Long. 17.35. N. Lat. 50.32.

NEIUS MONS (anc. geog.), at the foot of which stood Ithaca, a town of the island of that name, (Homer).

Nelson. NELSON (Robert), a learned and pious English gentleman, was the son of Mr John Nelson a considerable Turkey merchant, and was born in June 1656. He had the first part of his education at St Paul's school, London; but the principal part was under a private tutor in his mother's house, after which he studied at Trinity College, Cambridge. In 1680 he was chosen a fellow of the Royal Society; being probably inclined to receive that honour out of respect to his friend and schoolfellow Dr Edmund Halley, for whom he had a particular regard, and in whose company he set out on his travels abroad the December following. In the road to Paris, they saw the remarkable comet which gave rise to the cometical astronomy by Sir Isaac Newton; and our author, apparently by the advantage of his fellow traveller's instructions, sent a description of it to Dr, afterwards Archbishop, Tillotson, by whom he was very much esteemed. Before he left Paris, he received a letter from a friend in the English court, inviting him to purchase a place there, by the promise of his assistance in it. This proposal was made by Mr Henry Saville, brother to Lord Hallifax: he had been sworn vice-chamberlain of the King's household in December 1680, and was at this time envoy from Charles II. of the court of France; though now at London, whence he sent this offer in a letter to Mr Nelson; who, being but young, and having a great affection for King Charles and the duke of York, was pleased with the thoughts of figuring it near their persons; but as he could not resolve upon an affair of such consequence without the approbation of his mother and uncle, he first applied to Tillotson to sound them, with assurances of determining himself by their judgment and advice, including also that of the Dean: who finding them both averse to it, he thereupon dropped the matter, and pursued his journey with his fellow traveller to Rome. Here he fell into the acquaintance of Lady Theophila Lucy, widow of Sir Kingsmill Lucy of Broxburne in Hertfordshire, Bart. and second daughter of George earl of Berkeley, who soon discovered a strong passion for him: this concluded in marriage, after his arrival in England in 1682. But it was some time before she confessed to Mr Nelson the change of her religion; which was owing to her acquaintance with Bossuet, and conversations at Rome with Cardinal Philip Howard, who was grandson of the earl of Arundel, the collector of the Arundelian marbles, &c. and had been raised to the purple by Pope Clement X. in May 1675. Nor was this important alteration of her religious sentiments confined to her own mind, but involved in it her daughter by her first husband, whom she drew over to her new religion; and her zeal for it prompted her even to engage in the public controversy then depending. She is the supposed authoress of a piece written in 1686, 4to, under the title of, "A discourse concerning a judge of controversy in matters of religion, showing the necessity of such a judge."

This misfortune touched her husband very nearly. He employed not only his own pen, but those of his friends Dr Tillotson and Dr Hickes, to recover her; but all proved ineffectual; and she continued in the communion of the church of Rome till her death. She was a person of fine sense and understanding. Dr Tillotson particularly laments her case on that account; and even seems not to be entirely free from all apprehensions of the influence she might have upon her husband in this important affair. But Mr Nelson's religion was too much the result of his learning and reason to be shaken by his love, which was equally steady and inviolable. Her change of religion made no change in his affections for her; and when she relapsed into such a bad state of health as obliged her to go and drink the waters at Aix, he attended her thither in 1688: and not liking the prospect of the public affairs at home, he proceeded to make a second trip to Italy, taking his lady, together with her son and daughter by her former husband, along with him. He returned through Germany to the Hague, where he staid some time with Lord Dursley, who was married to his wife's sister.

From the Hague he arrived in England, in the latter end of 1691; where, being averse to the Revolution, he declared himself a Nonjuror, and left the communion of the church of England. In this last point he had consulted Dr Tillotson, and followed his opinion, who thought it no better than a trick, (detestable in any thing, and especially in religion), to join in prayers where there was any petition which was held to be sinful. Thus, notwithstanding their difference of opinion respecting the lawfulness of the Revolution, the friendship between them remained the same; and the good archbishop expired in his friend's arms in 1694. Nor did Mr Nelson's friendship end there; he continued it to his grace's widow, and was very instrumental in procuring her pension from the crown to be augmented from 400l. to 600l. *per annum*. It is very remarkable, that the great regard he had always shown to Tillotson, added to his own reputation for learning, judgment, and candour, induced Dr Barker, who published the archbishop's posthumous sermons, to consult our author on that occasion. Among the manuscripts, there was found one discourse wherein the archbishop took an occasion to complain of the usage which he had received from the Nonjuring party, and to expose, in return, the inconsistency of their own conduct; remarking particularly, that, upon a just comparison of their principle of non-resistance with their actual non-assistance to King James II. they had little reason to boast of their loyalty to him: and yet, severe as this discourse was upon that party, Mr Nelson, notwithstanding his attachment to them, was very zealous to have it printed, alleging, that they deserved such a rebuke for their unjust treatment of so good a man. However, the sermon was then suppressed, and is now probably lost.

Our author's new character unavoidably threw him into some new connexions. Among these we find mentioned particularly Mr Kettlewell, who had resigned his living at Coleshill in Warwickshire on account of the new oaths, and afterwards resided in London. This pious and learned divine also agreed with him, in leaving the communion of the established church; yet at the same time persuaded him to engage in the general service of piety and devotion; observing to him, that he was very able to compose excellent books of that kind, which would be apt to do more good as coming from a layman. This address

Nelson. corresponded with the truly catholic spirit of our author; who accordingly published many works of piety, which are deservedly esteemed. Indeed it was this spirit, more than their agreement in state principles, that first recommended them to one another. Mr Nelson is observed to have encouraged Kettlewell to proceed in that soft and gentle manner, in which he excelled, in managing the Nonjurors controversy; and animated him besides to begin and prosecute some things for a public good, which otherwise would not have seen the light. Mr Kettlewell died in 1695, and left Mr Nelson his sole executor and trustee; in consequence of which, he published a posthumous piece of piety, entitled, "An Office for Prisoners," &c. in 1697. He also published five other of his friend's posthumous pieces, and furnished the chief materials for the account of his life afterwards.

At the same time he engaged zealously in every public scheme for the honour and interest, as well as for propagating the faith, and promoting the practice, of true Christianity, both at home and abroad; several proposals for building, repairing, and endowing churches, and charity schools particularly.

Upon the death of Dr William Lloyd, the deprived bishop of Norwich, in the end of the year 1709, he returned to the communion of the church of England. Dr Lloyd was the last surviving of the deprived bishops by the Revolution, except Dr Kenn, by whose advice Mr Nelson was determined in this point. It had been a case in view some time, which had been bandied on both sides, whether the continuance of their separation from the church should be schismatical or no, when that case became a fact; and our author had some conferences upon it with Dr Hickes, who was for perpetuating the Nonjuring church, and charging the schism upon the church established. (See an account of this dispute, with some letters that passed between them on the occasion, in "The Constitution of the Catholic church, and the nature and consequences of Schism set forth, in a collection of papers written by the late George Hickes, D. D. 1716," 8vo.) Mr Nelson's tutor, Dr George Bull, bishop of St David's, dying before the expiration of this year, he was easily prevailed upon by that prelate's son to draw up an account of his father's life and writings, as he had maintained a long and intimate friendship with his lordship, which gave him an opportunity of being acquainted with his solid and substantial worth. The life was published in 1713; and as our author had long before laboured under a constitutional weakness, which had brought on an asthma and dropsy in the breast, the distemper grew to such a height soon after the publication of that work, that, for the benefit of the air, he retired at length to Kensington, where he expired on the 16th of January 1714-15, aged 59.

He was interred in the cemetery of St George's chapel, now a parochial church in Lamb's Conduit Fields, where a monument is erected to his memory, with a long and elegant Latin inscription, written by Bishop Smalridge. He was the first person buried in this cemetery; and as it was done to reconcile others to the place, who had taken an unsurmountable prejudice against it, so it proved a most prevailing precedent, and had the desired effect. He published several works of piety, and left his whole estate to pious and charitable uses, particularly to charity-schools. A good portrait of him was given by Mr Nichols, in 1779, to the Company of Stationers, and is placed in the parlour of their public hall. After the death of Sir Berkeley Lucy, Mr Nelson's library was sold by auction in 1760, together with that of Sir Berkeley, forming, united, a most extraordinary assemblage of devotion and infidelity. Several of Mr Nelson's original letters, highly characteristic of his benevolence, may be seen in the Anecdotes of Bowyer. Mr Nichols has also in his possession in MS. two excellent letters of advice from Mr Nelson to his young cousins George and Gabriel Hanger, on their going to settle in Turkey; which have been obligingly offered for the use of any future biographer, but are too long for our limits.

Nemausus. **NEMAUSUS**, or NEMAUSUM, (anc. geog.), the capital of the Arecomici in Gallia Narbonensis; a colony, (Coin), with the surname *Augusta*, (Inscription). In it stands a Roman amphitheatre. which is still almost entire. Now *Nismes* in Languedoc.

**NEMEA** (Strabo, Livy); a river of Achaia, running between Sicyon and Corinth, the common boundary of both territories, and falling into the Corinthian bay.

NEMEA (anc. geog.), situated between Cleonæ and Philus in Argolis; whether town, district, or other thing, uncertain; there a grove stood in which the Argives celebrated the Nemean games, and there happened all the fabulous circumstances of the Nemean lion. The district Nemea is called *Bembinadia*, (Pliny); a village, *Bembina*, standing near Nemea, (Strabo). Stephanus places Nemea in Elis; though not in Elis, but on its borders; Pliny, erroneously, in Arcadia. In the adjoining mountain is still shown the den of the lion, distant 15 stadia from the place *Nemea*, (Pausanias); in which stands a considerable temple of Jupiter Nemæus and Cleonæus, from the vicinity of these two places. This place gave name to the Nemæan games, celebrated every third year.

**NEMEAN** GAMES, so called from Nemea, a village between the cities of Cleonæ and Philus, where they were celebrated every third year. The exercises were chariot-races, and all the parts of the Pentathlum. These games were instituted in memory of Opheltes or Archemorus the son of Euphetes and Creusa, and who was nursed by Hypsipele; who leaving him in a meadow while she went to show the besiegers of Thebes a fountain, at her return found him dead, and a serpent twined about his neck: whence the fountain, before called *Langia*, was named *Archemorus*; and the captains, to comfort Hypsipele, instituted these games.—Others ascribe their institution to Hercules, after his victory over the Nemean lion. Others allow, that they were instituted first in honour of Archemorus; but intermitted, and revived again by Hercules. The victors were crowned with parsley, an herb used at funerals, and feigned to have sprung from Archemorus's blood. The Argives presided at these games.

Nemesianus. **NEMESIANUS** (Aurelius Olympius), a Latin poet who was born at Carthage, and flourished about the year 281, under the emperor Carus, and his sons Carinus and Numerian: the last of which emperors was so fond of poetry that he contested the glory with

Nemesianus,

Nemesianus, who had written a poem upon fishing and maritime affairs. We have still remaining a poem of our author called *Cynegeticon*, and four eclogues: they were published by Paulus Manutius in 1538; by Barthelet in 1613; at Leyden in 1653; with the notes of Janus Vlitias. Giraldi hath preserved a fragment of Nemesianus, which was communicated to him by Sannazarius, to whom we are obliged for our poet's works: for having found them written in Gothic characters, he procured them to be put into the Roman, and then sent them to Paulus Manutius. Although this poem hath acquired some reputation, it is greatly inferior to those of Oppian and Gratian upon the same subject; yet Nemesianus's style is natural enough, and has some degree of elegance. The world was so much possessed with an opinion of his poem in the eighth century, that it was read among the classics in the public schools, particularly in the time of Charlemagne, as appears from a letter of the celebrated Hincmar bishop of Rheims to his nephew Hincmar of Laon.

NEMESIS, in Pagan worship, the daughter of Jupiter and Necessity, or, according to others, of Oceanus and Nox, had the care of revenging the crimes which human justice left unpunished. She was also called *Adrastaea*, because Adrastus king of Argos first raised an altar to her; and *Rhamnusia*, from her having a magnificent temple at Rhamnus in Attica. She had likewise a temple at Rome in the Capitol. She is represented with a stern countenance, holding a whip in one hand and a pair of scales in the other.

NEMESIUS, a Greek philosopher who embraced Christianity, and was made bishop of Emesa in Phœnicia, where he had his birth; he flourished in the beginning of the fifth century. We have a piece by him entitled *De Natura Hominis*, in which he refutes the fatality of the Stoics and the errors of the Manichees, the Apollianarists, and the Eunomians; but he espouses the opinion of Origen concerning the pre-existence of souls (A). This treatise was translated by Valla, and printed in 1535. Another version was afterwards made of it by Ellebodius, and printed in 1665; it is also inserted in the *Bibliotheca Patrum*, in Greek and Latin. Lastly, Another edition was published at Oxford in 1671, folio, with a learned preface, wherein the editor endeavours to prove, from a passage in this book, that the circulation of the blood was known to Nemesius; which, however, was since shown to be a mistake by Dr Freind, in his *History of Physic*.

NEMINE CONTRADICENTE, "none contradicting it;" a term chiefly used in parliament when any thing is carried without opposition.

NEMOURS, a town of the Isle of France in the Gatinois, with the title of a duchy. It is seated on the river Loing, in E. Long. 2. 45. N. Lat. 48. 15.

NENAGH, a post and fair town of Ireland, in the county of Tipperary, and province of Munster, 75 miles from Dublin. It is situated on a branch of the river Shannon which runs into Lough-Derg. Here stands the ruins of an old castle called Nenagh-round. Also those of an hospital founded in the year 1200, for canons following the rule of St Augustin. It was dedicated to St John the Baptist, and was usually called *Tearhon*, or St John's house. In the reign of Henry III. a friary for conventual Franciscans was also founded here, and esteemed the richest foundation of that order in the kingdom. Here is a barrack for two troops of horse. This town was burnt on St Stephen's day 1348, by the Irish. The fairs held here are four.



NENIA, or NÆNIA, in the ancient poetry, a kind of funeral song sung to the music of flutes at the obsequies of the dead. Authors represent them as sorry compositions, sung by hired women mourners called *Præficæ*. The first rise of these Nenia is ascribed to the physicians. In the heathen antiquity, the goddess of tears and funerals was called *Nenia*; whom some suppose to have given that name to the funeral song, and others to have taken her name from it.

NEOCESARIA, (Pliny), a town of Pontus on the south or the left side of the Lycus. About the year 342, when Leontius and Sallustius were consuls, it was entirely ruined by a dreadful earthquake, no edifice having withstood the violence of the shock, except the church and the bishop's habitation, who was saved, with the clergy and some other pious persons, while the rest of the inhabitants were buried in its ruins.

NEOMAGUS, (Ptolemy); NOVIOMAGUS, (Antonine); a town of the Regni in Britain: now thought to be Guildford in Surry, (Lhuyd); or Croydon, (Talbot.) But Camden takes it to be Woodcote, two miles to the south of Croydon, where traces of an ancient town are still to be seen.

NEOMAGUS, (Ptolemy); *Noviomagus*, (Antonine); a town of the Treviri on the Moselle. Now *Numagen* 14 miles east, below Triers.

NEOMAGUS, (Ptolemy); *Noviomagus Lexoviorum*, (Antonine); a town of Gallia Celtica. Now *Lisieux*, in Normandy.

NEOMAGUS, (Ptolemy), *Noviomagus Nemetum*, (Antonine.) Now *Spire*, a city of the Palatinate, on the left or west side of the Rhine.

NEOMAGUS, (Ptolemy); a town of Gallia Narbonensis, on the confines of the Tricastini. Now *Nyons* in Dauphiné.

NEOMENIA, or NOUMENIA, a festival of the ancient Greeks, at the beginning of every lunar month, which, as the name imports, was observed upon the day of the new moon, in honour of all the gods, but especially Apollo, who was called *Neomenios*, because the sun is the fountain of light; and whatever distinction of times and seasons may be taken from other planets, yet they are all owing to him as the original of those borrowed rays by which they shine.

The games and public entertainments at these festivals were made by the rich, to whose tables the poor flocked in great numbers. The Athenians at these

(A) It is much more probable that he and Origen both brought their opinion with them from the schools of philosophy, than that either of them borrowed it from the other. See METAPHYSICS, Part III. Chap. IV.

these times offered solemn prayers and sacrifices for the prosperity of their country during the ensuing month. See GAMES.

The Jews had also their neomenia, or feast of the new moon, on which peculiar sacrifices were appointed: and on this day they had a sort of family entertainment and rejoicing. The most celebrated neomenia of all others was that at the beginning of the civil year, or first day of the mouth Tisri, on which no servile labour was performed: they then offered particular burnt sacrifices, and sounded the trumpets of the temple. The modern Jews keep the neomenia only as a feast of devotion, which any one may observe or not as he pleases.

NEOPHYTES, "new plants;" a name given by the ancient Christians to those heathens who had newly embraced the faith; such persons being considered as regenerated, or born anew by baptism. The term *neophytes* has been also used for new priests, or those just admitted into orders, and sometimes for the novices in monasteries. It is still applied to the converts made by the missionaries among the infidels.

NEPA, in zoology, a genus of insects belonging to the order of hemiptera. The rostrum is inflected; the antennæ are shorter than the thorax; and the hind feet are hairy, and fitted for swimming. There are seven species. The four wings are folded together crosswise, with the anterior part coriaceous. The two fore feet are cheliform, or resemble the claws of a crab; the other four are formed for walking. We have but three species of this genus, all three of which are found in the water, where they dwell, as do their larvæ and chrysalids. It is likewise in the water that we find the eggs of the water scorpion. Those eggs, of an oblong shape, have at one of their extremities two or more bristles or hairs. The insect sinks its egg into the stalk of a bullrush or some other water plant, so that the egg lies concealed, and only the hairs or bristles stick out, and are to be seen. One may easily preserve in water those stalks loaded with eggs, and see the young water scorpions hatched under one's own roof, or at least their larvæ. These insects are voracious, and feed on other aquatic animals, which they pierce and tear with their sharp rostrum, while they hold them with the forceps of their fore feet.—They fly well, especially in the evening and night, and they convey themselves from one pool to another, especially when that they are in begins to dry up. Mr Geoffroy asserts, that the pedes cheliformes, or fore feet of the nepa, are the antennæ of the insect, which, according to him, has but four feet.

NEPENTHES, in botany: A genus of the tetrandria order, belonging to the gynandria class of plants; and in the natural method ranking among those of which the order is doubtful. The calyx is quadripartite; there is no corolla; the capsule is quadrilocular.

NEPETA, CATMINT, or *Nep*, in botany: A genus of the gymnospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The under lip of the corolla has a small middle segment crenated; the margin of the throat is reflexed; the stamina approach one another. There are 14 species; the most remarkable is the cataria, common nep, or catmint. This is a native of many parts of Britain, growing about hedges and in waste places. The stalk is a yard high, and branched; the leaves are hoary; the flowers flesh coloured, growing verticillate in spikes at the tops of the branches: the middle segment of the lower lip is spotted with red. The plant has a bitter taste, and strong smell, not unlike pennyroyal. An infusion of this plant is reckoned a good cephalic and emmenagogue; being found very efficacious in chlorotic cases. Two ounces of the expressed juice may be given for a dose. It is called *catmint*, because cats are very fond of it, especially when it is withered; for then they will roll themselves on it, and tear it to pieces, chewing it in their mouths with great pleasure. Mr Ray mentions his having transplanted some of the plants of this sort from the fields into his garden, which were soon destroyed by the cats; but the plants which came up from seeds in his garden escaped: this verifies an old proverb, *viz.* "If you set it, the cats will eat it; if you sow it, the cats will not know it." Mr Withering is of opinion, that where there is a quantity of plants growing together, the cats will not meddle with them; but Mr Millar assures us, that he has frequently transplanted one of these plants from another part of the garden, within two feet of which some came up from seeds; in which case the latter have remained unhurt, when the former have been torn to pieces and destroyed: he acknowledges, however, that, where there is a large quantity of the herb growing together, they will not meddle with it. This plant is very hardy, and is easily propagated by seeds. If sown upon a poor dry soil, the plants will not grow too rank, but will continue longer, and appear much handsomer, than in rich ground, where they grow too luxuriant, and have not so strong a scent.



NEPHELIUM, in botany: A genus of the pentandria order, belonging to the monœcia class of plants. The male calyx is quinquidentate; there is no corolla: the female calyx is quadrifid; there is no corolla.—There are two germens and two styles on each: the fruit are two dry plumbs, muricated, and monospermous.

NEPHEW, a term relative to uncle and aunt, signifying a brother's or sister's son; who, according to the civil law, is in the third degree of consanguinity, but according to the canon in the second.

NEPHRITIC, something that relates to the kidneys. See KIDNEY.

*NEPHRITIC Wood, (lignum nephriticum)*, a wood of a very dense and compact texture, and of a fine grain, brought to us from New Spain in small blocks, in its natural state, and covered with its bark. It is to be chosen of a pale colour, sound and firm, and such as has not lost its acrid taste: for the surest test of it is the infusing it in water; for a piece of it infused only half an hour in cold water, gives it a changeable colour, which is blue or yellow as variously held to the light. If the vial it is in be held between the eye and the light, the tincture appears yellow; but if the eye be placed between the light and the vial, it appears blue. We often meet with this wood adulterated with others of the same pale colour; but the duskish black hue of the bark is a striking character of this.

The tree is the *coatli* of Hernandez. It grows to the height of our pear tree, and its wood while fresh is much of the same texture and colour; the leaves are small and oblong, not exceeding half an inch in length,

length, or a third of an inch in breadth the flowers are small, of a pale yellow colour, and oblong shape, standing in spikes: the cups they stand in are divided into five segments at the edge, and are covered with a reddish down. This is the best description of the tree that can be collected from what has been hitherto written of it; nobody having yet had an opportunity of taking its true characters.

This wood is said to be a very good diuretic; and we are told it is used among the Indians is all diseases of the kidneys and bladder, and in suppression of urine, from whatever cause. It is also recommended in fevers, and in obstructions of the viscera. The way of taking it among the Indians is only an infusion in cold water. These uses are not however properly ascertained. See GUILANDINA.

*NEPHRITIC Stone.* See *JADE Stone.*

NEPHRITICS, in pharmacy, medicines proper for diseases of the kidneys, especially the stone.—Such particularly are the roots of althæa, dog's grass, asparagus, sago, pellitory of the wall, mallows, pimpinella, red chick pease, peach kernels, turpentine, &c.

NEPHRITIS, or inflammation of the kidneys. See MEDICINE, N° 200.

NEPOS (Cornelius), a celebrated Latin biographer, who flourished in the time of Julius Cæsar, and lived, according to St Jerome, to the sixth year of Augustus. He was an Italian, if we may credit Catullus, and born at Hostilia, a small town in the territory of Verona, in Cisalpine Gaul. Ausonius, however, will have it that he was born in the Gauls: and in that they may both be in the right, provided that under the name of *Gaul* is comprehended *Gallia Cisalpina*, which is in Italy. Leander Alberti thinks Nepos's country was Verona; and he is sure that he was either born in that city or neighbourhood. For the rest, Cicero and Atticus were friends of our author; who wrote the lives of the Greek historians, as he himself attests in that of Dion, speaking of Philistus. What he says, also, in the lives of Cato and Hannibal, proves that he had also written the lives of the Latin captains and historians. He wrote some other excellent works which are lost.

All that we have left of his at present is, "The Lives of the illustrious Greek and Roman Captains;" which were a long time ascribed to Æmilius Probus, who published them, as it is said, under his own name, to insinuate himself thereby into the favour of the emperor Theodosius; but, in the course of time, the fraud has been discovered, although several learned persons have confounded the two authors. This piece has been translated into French by the Sieur de Claveret, with a dedication to the duke of Longueville, in 1663; and again by M. le Gras, then of the congregation of the Oratory at Paris 1729, 12mo. We have an excellent translation of it into English, by several hands at Oxford, which has gone through several editions.

NEPTUNE, in Pagan worship, the god of the sea, was the son of Saturn and Vesta or Ops, and the brother of Jupiter and Pluto. He assisted Jupiter in his expeditions; on which that god, when he arrived at the supreme power, assigned him the sea and the islands for his empire. He was, however, expelled from heaven with Apollo for conspiring against Jupiter, when they were both employed by Laomedon king of Phrygia in building the walls of Troy; but that prince dismissing Neptune without a reward, he sent a sea monster to lay waste the country, on which he was obliged to expose his daughter Hesione. He is said to have been the first inventor of horsemanship and chariot racing; on which account Mithridates king of Pontus threw chariots drawn by four horses into the sea in honour of this god; and the Romans instituted horse races in the circus at his festival, during which all other horses left working, and the mules were adorned with wreaths of flowers.



In a contest with Minerva he produced a horse by striking the earth with his trident; and on another occasion, in a trial of skill with Minerva and Vulcan, produced a bull, whence that animal was sacrificed to him. His favourite wife was Amphytrite, whom he long courted in vain, till sending a dolphin to intercede for him, he met with success; on which he rewarded the dolphin by placing him among the stars. He had also two other wives, one of whom was called *Salasia* from the salt water; the other *Venilia* from the ebbing and flowing of the tides. He had likewise many concubines, by whom he had a great number of children. He is represented with black hair, with a garment of an azure or sea green, holding his trident in his hand, and seated in a large shell drawn by sea horses, attended by the sea gods Palemon, Glaucus, and Phorcys, and the sea goddesses Thetis, Melita, and Panopæa, and a long train of tritons and sea nymphs.

This deity was in Egypt known by the name of *Canobus* or *Canopus*, and was worshipped as the *numen aquarum* or spirit of the Nile. His emblem was the figure of certain vases or pitchers, with which the Egyptians filtrated the water of their sacred river, in order to purify and render it fit for use. From the mouth of each of these vases, which were charged with hieroglyphics, arose the head, and sometimes the head and hands, of a man or woman. Such are the emblems which still remain of the Egyptian Neptune or Canobus; and it was by this emblem that the tutelar god of Egypt vanquished the god of Chaldea in the ridiculous manner mentioned by Ruffinus in his ecclesiastical history †

"The Chaldæans (says he) who adored the fire, carried their god into various countries that he might try his strength in contests with other gods. He vanquished, as we may easily conceive, the images made of gold, silver, brass, and wood, &c. by reducing them to ashes; and thus the worship of fire was everywhere established. The priest of Canobus, unwilling, as became him, to admit the superiority of strange gods, contrived to make his god vanquish the god of Chaldea in a pitched battle. The vases which were worshipped as the emblems of Canobus being used for filtering the waters of the Nile, were of course perforated on all sides with very small holes. This faithful priest having stopped all the holes in one of these with wax, and painted the vase of different colours for a reason which the reader will admit to be a good one, filled it up with water, and fitted to its mouth the head of an idol. This emblem of Canobus was then placed in a small fire brought by the Chaldeans,

† Lib. ii. cap.

Chaldæans as the emblem of their god; and thus the gods of Egypt and Chaldæa were forced into battle. The contest, however, was of short duration. The heat melting the wax made way for the water to run out, which quickly extinguished the fire; and thus Canobus vanquished the god of the Chaldæans." Ridiculous as this story is, it is perfectly suitable to the genius of Paganism, and the mean artifices of the Pagan priesthood; but we suspect that the historian laboured under one mistake, and substituted the Chaldæans instead of the Persians. See POLYTHEISM.

NEREIDS, in the Pagan theology, sea nymphs, daughters of Nereus and Doris.—The Nereids were esteemed very handsome; insomuch that Cassiope, the wife of Cepheus king of Ethiopia, having triumphed over all the beauties of the age, and daring to vie with the Nereids, they were so enraged that they sent a prodigious sea monster into the country; and, to appease them, she was commanded by the oracle to expose her daughter Andromeda, bound to a rock, to be devoured by the monster. In ancient monuments, the Nereids are represented riding upon sea horses; sometimes with an entire human form, and at other times with the tail of a fish.

NEREIS, in zoology, a genus of animals belonging to the order of vermes mollusca. The body is oblong, linear, and fitted for creeping; it is furnished with lateral pencilled tentacula. There are 11 species; of which the most remarkable are the five following:

Plat CCCXLV. fig. 1 1. The *noctiluca*, or noctilucous nereis, which inhabits almost every sea, and is one of the causes of the luminousness of the water. These creatures shine like glow-worms, but with a brighter splendour, so as at night to make the element appear as if on fire all around. Their bodies are so minute as to elude examination by the naked eye.

It is sometimes called *nereis phosphorans;* and is thus described by Griselin: The head is roundish and flat, and the mouth acuminated. The two horns or feelers are short and subulated. The eyes are prominent, and placed on each side the head. The body is composed of about 23 segments or joints, which are much less near the tail than at the head. These segments on both sides the animal all end in a short conical apex, out of which proceeds a little bundle of hairs: from under these bundles the feet grow in the form of small flexile subulated figments destitute of any thing like claws. It is scarcely two lines long, and is quite pellucid, and its colour is that of water green. They are found upon all kinds of marine plants; but they often leave them, and are found upon the surface of the water; they are frequent at all seasons, but especially in summer before stormy weather, when they are more agitated and more luminous. Their numbers, and wonderful agility, added to their pellucid and shining quality, do not a little contribute to their illuminating the sea, for myriads of those animalculæ may be contained in the portion of a small cup of sea water. Innumerable quantities of them lodge in the cavities of the scales of fishes, and to them probably do the fishes owe their noctilucous quality. "I have observed with great attention (says Barbut), a fish just caught out of the sea, whose body was almost covered with them; and have examined them in the dark: they twist and curl themselves with amazing agility, but soon retire out of our contracted sight; probably their glittering numbers dazzling the eye, and their extreme minuteness eluding our researches. It is to be observed, that when the unctuous moisture which covers the scales of fishes is exhausted by the air, these animals are not to be seen; nor are the fishes then noctilucous, that matter being perhaps their nourishment when living, as they themselves afford food to many marine animals. They do not shine in the day time, because the solar rays are too powerful for their light, however aggregate or immense their number." Their appearance is particularly brilliant when the wind is in the east and south-east points, and in winter nights preceded by a warm day. If water containing these animalcules be kept warm, they retain their light two whole days after they are dead; but in cold water lose it in eight hours: motion and warmth, which increase their vivacity and strength, increase their light also.



2. *Nereis lacustris*, or bog nereis. The body of the size of a hog's short bristle, transparent, as it were articulated, and on either side at every articulation provided with a short setaceous foot; interiorly it seems to consist in a manner of oval-shaped articulations, and a back formed by two lines bent backwards. It inhabits marshes abounding in clay, where it remains under ground, pushing out its other extremity by reason of its continual motion. When taken out it twists itself up. Is frequent in Sweden. Fig. 2.

3. *Nereis cirrosa*, or waving nereis. The body is red, lumbriciform, with 65 notches, furnished on both sides with two rows of bristles. At each side of the head ten filaments, at the sides of the mouth many, twice as long as the former. It dwells in Norway, on rocks at the bottom of the sea. It vomits a red liquor with which it tinges the water. Fig. 3.

4. *Nereis cærulea*, or blue nereis. It inhabits the ocean; where it destroys the serpulæ and teredines. Fig. 4.

5. *Nereis gigantæa*, or giant nereis. This is a peculiar species of those large worms that make their way into decayed piles driven down into the sea, which they bore through and feed upon, whence they are called *sea worms* or nereis. From head to tail they are beset on either side with small tufts terminating in three points; which are like the fine hair pencils used by painters, and composed of shining bristles of various colours. The upper part of the body in this worm is all over covered with small hairs. The rings of which it is formed are closely pressed together, and yield to the touch. The three rows of small tufts we have been describing, serve this nereis instead of feet, which it uses to go forwards as fishes do their fins. Fig. 5.

NEREUS, (fab. hist.), a marine deity, was the son of Oceanus and Thetis. He settled in the Ægean sea, was considered as a prophet, and had the power of assuming what form he pleased. He married his sister Doris, by whom he had 50 daughters called the *Nereids*, who constantly attended on Neptune, and when he went abroad surrounded his chariot.

NERI (S. Philippe de), founder of the congregation of the Oratory in Italy, was born of a noble family at Florence, on the 25th of July 1515. Educated in the principles of piety and learning, he soon became

Neri Nero.

became distinguished for his knowledge and virtue. At the age of 19 he went to Rome, where he improved his mind, assisted the sick, and gave many proofs of self-denial and humility. Philippe, being raised to the priesthood at the age of 36, instituted, in 1550, a celebrated fellowship in the church of St Saviour del Campo, for the relief of poor foreigners, of pilgrims, and of convalescents, who had no place whither they could retire. This society was the cradle, if we may say so, of the congregation of the Oratory. The holy founder having gained over to God Salviati brother to the cardinal of the same name, Tarugio afterwards cardinal, the celebrated Baronius, and several others, they began to form themselves into a society in 1564. The spiritual exercises had been transferred in 1558 to the church of Saint Jerome de la Charité, which Philippe did not leave till 1574, when he went to stay at Saint John of the Florentines. Pope Gregory XIII. gave his approbation of the congregation in the following year. The father of this new warfare sent out some of his children, by whom his order was spread thoughout Italy. Nor is there any reason to be surprised at its rapid success. No vow is taken in this congregation; charity is the only bond of connexion. The general continues only three years in office, and his orders are not those of a tyrant or a despot. The founder died at Rome on the night between the 25th and 26th of May 1595, aged 80. He had resigned the generalship three years before in favour of Baronius, who, by his advice, was engaged in the ecclesiastical annals. The constitutions which he left for his congregation were not printed till 1612. The principal employment which he allots to the priests of his order, is to give, every day, in their oratory or church, instructions suited to the understandings of their hearers: an office truly apostolical, and which the followers of Neri discharge with success. They humble themselves, that they may exalt to God the soul of the simple. Philippe was canonized in 1622 by Gregory XV.

There was a learned man of the name of Neri (Anthony), from whom we have a curious book printed at Florence 1612, in 4to, with this title *Dell' Arte verraria Libri VII.*; and a Dominican named *Thomas Neri*, who employed his pen in defence of his fellow monk, the famous Savonarole.

NERIUM, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 30th order, *Contortæ*. There are two erect follicles; the seeds plumy; the tube of the corolla terminated by a lacerated crown. There are five species, all of them natives of the warmer climates: the most remarkable of which are, 1. The oleander, South sea rose: this is a beautiful shrub, cultivated in gardens on account of its flowers, which are of a fine purple, and in clusters, but of an indifferent smell: the whole plant is poisonous, and especially the bark of the roots. 2. The antidysintericum, a native of Ceylon: the bark of which is an article of materia medica, under the name of *Conessi*. 3. The tinctorium, a new species with beautiful blue flowers lately discovered by Dr Roxburgh at Madras. A decoction of the leaves, with an addition of lime water, makes an indigo of fine quality.

NERO (Claudius Domitius Cæsar), a celebrated Roman emperor, son of Caius Domitius Ahenobarbus and Agrippina the daughter of Germanicus. He was adopted by the emperor Claudius, A. D. 50, and four years after he succeeded to him on the throne. In the beginning of his reign he showed several marks of the greatest kindness and condescension, affability, complaisance, and popularity. The object of his administration seemed to be the good of his people; and when he was desired to sign his name to a list of malefactors that were to be executed, he exclaimed, *Would to heaven I could not write!* He hated flattery; and when the senate had liberally commended the wisdom of his government, he desired them to keep their praises till he deserved them. These promising virtues soon, however, proved to be artificial: Nero soon displayed the real propensities of his nature. He delivered himself from the sway of his mother, and at last ordered her to be murdered. This unnatural act of barbarity might astonish some, but Nero had his devoted adherents; and when he declared that he had taken away his mother's life to save himself from ruin, the senate applauded his measures, and the people signified their approbation. Many of his courtiers shared her unhappy fate; and Nero sacrificed to his fury or caprice all such as obstructed his pleasure or diverted his inclination. In the night he generally went from his palace to visit the meanest taverns, and all the scenes of debauchery which Rome contained. In this nocturnal riot he was fond of insulting the people in the streets; and his attempts to offer violence to the wife of a Roman senator nearly cost him his life. He also turned actor, and openly appeared on the Roman stage in the meanest characters. In his attempts to excel in music, and to conquer the disadvantages of a hoarse disagreeable voice, he moderated his meals, and often passed the day without eating. The Olympian games attracted his notice: he went into Greece, and presented himself a candidate for the public honour. He was defeated in wrestling; but the flattery of the spectators adjudged him the victory, and he returned to Rome with all the pomp and splendour of an eastern conqueror, drawn in the chariot of Augustus, and attended by a band of musicians, actors, and stage-dancers from every part of the empire. These private and public amusements of the emperor were indeed innocent; his character only was injured, and not the lives of the people. His conduct, however, soon became more abominable: he disguised himself in the habit of a woman, and was publicly married to one of his eunuchs. This violence to nature and decency was soon exchanged for another: Nero resumed his sex, and celebrated his nuptials with one of his meanest catamites: and it was on this occasion that one of the Romans observed that the world would have been happy if Nero's father had had such a wife. But his cruelty was now displayed in a still higher degree, for he sacrificed to his wantonness his wife Octavia Poppæa, and the celebrated writers, Seneca, Lucan, Petronius, &c. Nor did the Christians escape his barbarity. He had heard of the burning of Troy; and as he wished to renew that dismal scene, he caused Rome to be set on fire in different places. The conflagration became soon universal, and during nine successive days the fire continued. All was desolation: nothing was heard but the lamentations of mothers whose

Nero. whose children had perished in the flames, the groans of the dying, and the continual fall of palaces and buildings. Nero was the only one who enjoyed the general consternation. He placed himself on the top of a high tower, and he sung on his lyre the destruction of Troy, a dreadful scene which his barbarity had realized before his eyes. He attempted to avert the public odium from his head by a pretended commiseration of the miseries of his subjects. He began to repair the streets and the public buildings at his own expence. He built himself a celebrated palace, which he called his golden house. It was liberally adorned with gold, with precious stones, and with every thing rare and exquisite. It contained spacious fields, artificial lakes, woods, gardens, orchards, and whatever exhibited a beautiful scene. The entrance of this edifice could admit a large colossus of the emperor 120 feet high; the galleries were each a mile long, and the whole was covered with gold. The roofs of the dining halls represented the firmament, in motion as well as in figure; and continually turned round night and day, showering down all sorts of perfumes and sweet waters. When this grand edifice, which, according to Pliny, extended all round the city, was finished, Nero said, that now he could lodge like a man. His profusion was not less remarkable in all his other actions. When he went a fishing, his nets were of gold and silk. He never appeared twice in the same garment; and when he took a voyage, there were thousands of servants to take care of his wardrobe. This continuation of debauchery and extravagance at last roused the people. Many conspiracies were formed against him; but they were generally discovered, and such as were accessory suffered the severest punishments. The most dangerous conspiracy against Nero's life was that of Piso, from which he was saved by the confession of a slave. The conspiracy of Galba proved more successful, who, when he was informed that his plot was known to Nero, declared himself emperor. The unpopularity of Nero favoured his cause; he was acknowledged by all the Roman empire, and the senate condemned the tyrant to be dragged naked through the streets of Rome, and whipped to death, and afterwards to be thrown down from the Tarpeian rock like the meanest malefactor. This, however, was not executed; for Nero prevented it by a voluntary death. He killed himself, A. D. 68, in the 32d year of his age, after a reign of 13 years and eight months. Rome was filled with acclamations at it; and the citizens, more strongly to indicate their joy, wore caps, such as were generally used by slaves who had received their freedom. Their vengeance was not only exercised against the statues of the deceased monster, but many of his friends were the object of the public resentment; and many were crushed to pieces in such a violent manner, that one of the senators, amid the universal joy, said that he was afraid they should soon have cause to wish for Nero. The tyrant, as he expired, requested that his head might not be cut off from his body, and exposed to the insolence of the populace, but that the whole might be burned on the funeral pile. His request was granted by one of Galba's freedmen, and his obsequies were performed with the usual ceremonies. Though his death seemed to be the source of general gladness, yet many of his favourites lamented his fall, and were grieved to see that their pleasures and amusements were stopped by the death of this patron of debauchery and extravagance. Even the king of Parthia sent ambassadors to Rome, to condole with the Romans, and to beg that they would honour and revere the memory of Nero. His statues were also crowned with garlands of flowers; and many imagined that he was not dead, but that he would soon make his appearance and take vengeance on his enemies. It will be sufficient to observe, in finishing the character of this tyrannical monster, that the name of *Nero* is even now used emphatically to express a barbarous and unfeeling oppressor. Pliny calls him the common enemy and fury of mankind; and so indeed he has been called by all writers, who exhibit Nero as a pattern of the most execrable barbarity and unpardonable wantonness. The same Pliny furnishes us with this singular anecdote of him: "Nero had ordered himself to be painted under the figure of a colossus, upon cloth or canvas, 120 feet in height." He adds, "that this preposterous picture, when it was finished, met with its fate from lightning, which consumed it, and involved likewise the most beautiful part of the gardens where it was placed in the conflagration."

Nerva, Nerves.

NERVA (Cocceius), a Roman emperor after Domitian, who was the last of the 12 Cæsars. He was a native of Narnia in Umbria; his family however was originally of Crete. Dion Cassius says he was born on the 17th of March, in the 18th year of Tiberius's reign, and of the Christian era the 32d. Nero in the 12th year of his reign made him prætor, and erected a statue for him in the palace on account of his poems (for he was one of the best poets of his age), some of which were inscribed to him. He was consul in 71 with Vespasian, and in 90 with Domitian.

Ancient authors uniformly celebrate him as a prince of a most mild and humane temper, of great moderation and generosity, who looked on his office as emperor, not as if it was for his own advantage, but for that of his people; and whilst he reigned, which was however but for a short time, he made the happiness of his subjects his only end and pursuit. He narrowly escaped death under Domitian; was naturally of a weak and timorous disposition; and, as some say, addicted to excessive drinking. The Romans unanimously chose him emperor; and they had no cause to repent of their choice, for he was constantly attentive to what could make them happy; he was generous, merciful, and disinterested. An instance of his great lenity appears in his pardoning Calpurnius Crassus who conspired against him. In short, he omitted nothing that might contribute to the restoring of the empire to its former lustre: recalling those who had been banished for religion, and redressing all grievances that came to his knowledge. He however found his strength failing, and that it would be impossible for him to finish his designs, in consequence of which he adopted Trajan. After his death, which happened in the year 98, he was ranked among the gods. He was the first Roman emperor of foreign extraction.

NERVES, in anatomy, certain white glistening cords, proceeding from the brain and spinal marrow, and dividing into very small branches, which are sent off throughout all parts of the body; and which are found

Nervous
‖
Nestor.

found to be the organs of sensation and motion. See ANATOMY, N° 136.

NERVOUS FLUID. See ANATOMY, N° 136.

NESSUS (fab. hist.), a celebrated Centaur, son of Ixion and a Cloud. He offered violence to Dejanira whom Hercules had entrusted to his care, with orders to carry her across the river Evenus. Hercules saw the distress of his wife from the opposite shore of the river, and immediately he let fly one of his poisoned arrows, which struck the Centaur to the heart. Nessus, as he expired, gave the tunic he then wore to Dejanira, assuring her that from the poisoned blood which had flowed from his wounds, it had received the power of calling a husband away from unlawful loves. Dejanira received it with pleasure, and this mournful present caused the death of Hercules.——A river which separates Thrace from Macedonia. It is also called *Nesus*, *Nestos*, and *Nestus*.

NEST. See NIDUS.

*Eatable Birds NESTS*. See *BIRDS Nests*.

NESTOR (fab. hist.), a son of Neleus and Chloris, nephew to Pelias and grandson to Neptune. He had eleven brothers, who were all killed with his father by Hercules. His tender age detained him at home, and was the cause of his preservation. The conqueror spared his life and placed him upon the throne of Pylos. He married Eurydice the daughter of Clymenus; or, according to others, Anaxibia the daughter of Atreus. He soon distinguished himself in the field of battle; and was present at the nuptials of Perithous, when a bloody engagement took place between the Lapithæ and Centaurs. As king of Pylos and Messenia he led his subjects to the Trojan war, where he distinguished himself among the rest of the Grecian chiefs, by eloquence, address, wisdom, justice, and uncommon prudence. Homer displays his character as the most perfect of all his heroes; and Agamemnon exclaims, that if he had 20 generals like Nestor, he should soon see the walls of Troy reduced to ashes. After the Trojan war Nestor retired to Greece, where he enjoyed in the bosom of his family the peace and tranquillity which were due to his wisdom and to his age. The manner and the time of his death are unknown: the ancients are all agreed that he lived three generations of men; which length of time is supposed to be 300 years, though more probably only 90 years, allowing 30 years for each generation. From that circumstance, therefore, it was usual among the Greeks and the Latins, when they wished a long and happy life to their friends, to wish them to see the years of Nestor. He had many children; two daughters, Pisidice and Polycaste; and seven sons, Perseus, Straticus, Aretus, Echephron, Pisistratus, Antilochus, and Thrasymedes. Nestor was one of the Argonauts, according to Valerius Flaccus, v. 380, &c.—A poet of Lycaonia in the age of the emperor Severus. He was father to Pisander, who under the emperor Alexander wrote some fabulous stories——One of the body guards of Alexander.

NESTOR, whose secular name is not known, was a native of Russia, and the earliest historian of the north. He was born in 1056 at Bielozero; and in the 19th year of his age he assumed the monastic habit in the convent of Petcherski at Kiof, and took the name of *Nestor*. He there made a considerable proficiency in the Greek language: but seems to have formed his style and manner rather from the Byzantine historians, Cedrenus, Zonaras, and Syncellus, than from the ancient classics. The time of Nestor's death is not ascertained; but he is supposed to have lived to an advanced age, and to have died about the year 1115.

Nestor,
Nestorians.

His great work is his Chronicle, to which he has prefixed an introduction, which after a short sketch of the early state of the world, taken from the Byzantine writers, contains a geographical description of Russia and the adjacent regions; an account of the Sclavonian nations, their manners, their emigrations from the banks of the Danube, their dispersion, and settlement in the several countries wherein their descendants are now established. He then enters upon a chronological series of the Russian annals, from the year 858 to about 1113. His style is simple and unadorned, such as suits a mere recorder of facts; but his chronological exactness, though it renders his narrative dry and tedious, contributes to ascertain the era and authenticity of the events which he relates.

It is remarkable (says Mr Coxe, from whom we have taken this narrative), that an author of such importance, whose name frequently occurs in the early Russian books, should have remained in obscurity above 600 years; and been scarcely known to his modern countrymen, the origin and actions of whose ancestors he records with such circumstantial exactness. A copy of his Chronicle was given in 1668 by Prince Radzivil to the library of Konigsburg, where it lay unnoticed till Peter the Great in his passage through that town, ordered a transcript of it to be sent to Petersburgh. But it still was not known as the performance of Nestor: for when Muller in 1732 published the first part of a German translation, he mentioned it as the work of the abbot Theodosius of Kiof; an error which arose from the following circumstance: The ingenious editor not being at that time sufficiently acquainted with the Sclavonian tongue, employed an interpreter, who, by mistaking a letter in the title, supposed it to have been written by a person whose name was Theodosius. This ridiculous blunder was soon circulated, and copied by many foreign writers, even long after it had been candidly acknowledged and corrected by Muller.

NESTORIANS, a sect of ancient Christians, still said to be subsisting in some parts of the Levant; whose distinguishing tenet is, that Mary is not the mother of God. They take their name from Nestorius bishop of Constantinople, whose doctrines were spread with much zeal through Syria, Egypt, and Persia.

One of the chief promoters of the Nestorian cause was Barsumas, created bishop of Nisibis, A. D. 435. Such was his zeal and success, that the Nestorians, who still remain in Chaldea, Persia, Assyria, and the adjacent countries, consider him alone as their parent and founder. By him Pherozes the Persian monarch was persuaded to expel those Christians who adopted the opinions of the Greeks, and to admit the Nestorians in their place, putting them in possession of the principal seat of ecclesiastical authority in Persia, the see of Seleucia, which the patriarch of the Nestorians has always filled even down to our time.—Barsumas also erected a school at Nisibis, from which

 proceeded

Nestorians. proceeded those Nestorian doctors who in the fifth and sixth centuries spread abroad their tenets through Egypt, Syria, Arabia, India, Tartary, and China.

He differed considerably from [Nesto]rius, holding that there are two persons in Jesus Christ, as well as that the Virgin was not his mother, as God, but only as man.

The abettors of this doctrine refuse the title Nestorians; alleging that it had been handed down from the earliest times of the Christian church.

In the tenth century, the Nestorians in Chaldea, whence they are sometimes called *Chaldeans*, extended their spiritual conquests beyond Mount Imaus, and introduced the Christian religion into Tartary properly so called, and especially into that country called *Karit*, bordering on the northern part of China. The prince of that country, whom the Nestorians converted to the Christian faith, assumed, according to the vulgar tradition, the name of *John* after his baptism, to which he added the surname of *Presbyter*, from a principle of modesty; whence it is said his successors were each of them called *Prester John* until the time of Gengis Khan. But Mosheim observes, that the famous Prester John did not begin to reign in that part of Asia before the conclusion of the 11th century. The Nestorians formed so considerable a body of Christians, that the missionaries of Rome were industrious in their endeavours to reduce them under the papal yoke. [Innoc]ent IV. in 1246 and Nicolas IV. in 1278, used their utmost efforts for this purpose, but without [suc]cess. Till the time of Pope Julius III. the Nestorians acknowledged but one patriarch, who resided at Bagdad, and afterwards at Mousul; but a division arising among them, in 1551 the patriarchate became divided, at least for a time, and a new patriarch was consecrated by that pope, whose successors fixed their residence in the city of Ormus in the mountainous part of Persia, where they still continue, distinguished by the name of *Simeon*; and so far down as the last century, these patriarchs persevered in their communion with the church of Rome, but seem at present to have withdrawn themselves from it. The great Nestorian pontiffs, who form the opposite party, and look with a hostile eye on this little patriarch, have since the year 1559 been distinguished by the general denomination of Elias, and reside constantly in the city of Mousul. Their spiritual dominion is very extensive, takes in a great part of Asia, and comprehends also within its circuit the Arabian Nestorians, and also the Christians of St Thomas, who dwell along the coast of Malabar. It is observed, to the lasting honour of the Nestorians, that of all the Christian societies established in the East, they have been the most careful and successful in avoiding a multitude of superstitious opinions and practices that have infected the Greek and Latin churches. About the middle of the 17th century, the Romish missionaries gained over to their communion a small number of Nestorians, whom they formed into a congregation or church; the patriarchs or bishops of which reside in the city of Amida, or Diarbeker, and all assume the denomination of *Joseph*. Nevertheless the Nestorians in general persevere to our own times in their refusal to enter into the communion of the Romish church, notwithstanding the earnest entreaties and alluring offers that have been made by the pope's legate to conquer their inflexible constancy.

Nestorius. NESTORIUS, from whom the sect of Nestorian Christians derive their name, was born in Germanica a city of Syria. He received his education at Antioch, where he was likewise baptized; and soon after his baptism he withdrew himself to a monastery in the suburbs of that city. Upon his being admitted to the order of priestood, he quickly acquired so great reputation by the eloquence of his preaching, and the regularity of his life, that by the emperor Theodosius he was deemed a fit person to fill the second see in the Christian church, and was accordingly consecrated bishop of Constantiople in the year 429.

In one of his first sermons after his promotion, he publicly declared his intention to *make war upon heretics;* and with that intolerant spirit which has so often disgraced the preachers of the mild religion of Jesus, he called upon the emperor to *free the earth from heretics*, promising to give him heaven as a reward for his zeal. To this spiritual motive he added one, that, though carnal, he possibly judged of equal force:—"Join with me (said he) in war against them, and I will assist you against the Persians." Although the wiser and better part of his audience were amazed to see a man, before he had tasted (as the historian * expresses himself) the water of his city, declare that he would persecute all who were not of his opinion; yet the majority of the people approved of this discourse, and encouraged him to execute his purpose. Accordingly, five days after his consecration, he attempted to demolish the church in which the Arians secretly held their assemblies; and he succeeded so far in his design, that these people, growing desperate, set it on fire themselves, and consumed with it some of the neighbouring houses. This fire excited great commotions in the city, and Nestorius was ever afterwards called *incendiary*.

From the Arians he turned his persecution against the Novatians, but was stopped in his career by the interposition of the emperor. He then let loose his fury [on] those Christians of *Asia, Lydia,* and *Caria*, who celebrated the feast of Easter upon the 14th day of the moon; and for this unimportant deviation from the Catholic practice, many of those people were murdered by his agents both at Miletum and Sardis.—One cannot be sorry that such a relentless persecutor should himself be afterwards condemned as a heretic, for holding an opinion which no man who speaks or thinks with philosophic accuracy will now venture to controvert. This obnoxious tenet which produced a schism in the church, and was condemned by a general council, was nothing more than that "the Virgin Mary cannot with propriety be called the mother of God." The people being accustomed to hear this expression, were much inflamed against their bishop, imagining that he had revived the error of *Paulus Samosatenus* and *Photinus*, who taught that Jesus Christ was a mere man. The monks declared openly against him, and, with some of the most considerable men in Constantinople, separated themselves from his communion. Several bishops wrote to him earnest persuasives to acknowledge that Mary was the mother of God; and when he would not comply, they procured his condemnation

* *Socrates.*

Nestorius || Net.

condemnation in the council of Ephesus, which deprived him of his see. He then retired to his ancient monastery at Antioch, whence he was taken four years afterwards by the emperor's order, and banished in 435 to Tarsus. That city being taken and destroyed by the barbarians, he was removed to Panopolis, a city of Thebais; where he was not suffered to remain long, but was compelled to go from place to place, till, being in one of his journeys mortally bruised by a fall, death relieved him from the fury of his persecutors.

If we examine such of his writings as remain, we shall find that he was very unjustly condemned. It appears that he rejected the errors of *Ebion*, *Paulus Samosatenus*, and *Photinus*; that he maintained in express terms, that the divine Word was united to the human nature in Jesus Christ in the most strict and intimate sense possible; that these two natures, in this state of union, make but one Christ and one person; that the properties of the Divine and human natures may both be attributed to this person; and that Jesus Christ may be said to have been born of a virgin, to have suffered and died; but he never would admit that God could be said to have been born, to have suffered, or to have died.—When we consider that every person partakes of the substance of his mother, and that it is this which constitutes the parental and filial relation between them, it is indeed surprising that the expression "Mother of God" should ever have been admitted into the Christian church, or that any man who understands the meaning of the words should condemn Nestorius for not having used them.

NESTUS, or NESSUS, a river which separates Thrace from Macedonia. It falls into the Ægean sea near the island Thasos. It is sometimes called *Nesus* and *Nessus*.

NET, a device for catching fish and fowl. See the article FISHERY.

The taking fowls by nets is the readiest and most advantageous of all others, where numbers are to be taken. The making the nets is very easy, and what every true sportsman ought to be able to do for himself. All the necessary tools are wooden needles, of which there should be several of different sizes, some round and others flat; a pair of round pointed and flat scissars; and a wheel to wind off the thread. The packthread is to be of different strength and thickness, according to the sort of birds to be taken; and the general size of the meshes, if not for very small birds, is two inches from point to point. The nets should neither be made too deep nor too long, for they are then difficult to manage; and they must be verged on each side with twisted thread. The natural colour of the thread is too bright and pale, and is therefore in many cases to be altered. The most usual colour is the russet; which is to be obtained by plunging the net, after it is made, into a tanners pit, and letting it lie there till it be sufficiently tinged: this is of a double service to the net, since it preserves the thread as well as alters the colour. The green colour is given by chapping some green wheat and boiling it in water, and then soaking the net in this green tincture. The yellow colour is given in the same manner with the decoction of celandine; which gives a pale straw-colour, which is the colour of stubble in the harvest-time. The brown nets are to be used on ploughed lands, the green on grass grounds, and the yellow on stubble lands.

Net.

*Net-Day*, among fowlers, a net generally used for taking such small birds as play in the air, and will stoop either to prey, gig, or the like; as larks, linnets, buntings, &c. The time of the year for using this net is from August to November; and the best time is very early in the morning: and it is to be observed, that the milder the air, and the brighter the sun is, the better will be the sport, and of longer continuance. The place where this net should be laid, ought to be plain champaign, either on short stubbles, green lays, or flat meadows, near corn fields, and somewhat remote from towns and villages: you must be sure to let your net lie close to the ground, that the birds creep not out and make their escape.—The net is made of a fine packthread with a small mesh, not exceeding half an inch square; it must be three fathoms long, and but one broad: it must be verged about with a small but strong cord; and the two ends extended upon two small long poles, suitable to the breadth of the net, with four stakes, tail-strings, and drawing-lines.—This net is composed of two, which must be exactly alike; and are to be laid opposite to one another, so even and close, that when they are drawn and pulled over, the sides must meet and touch each other. You must stake this net down with strong stakes, very stiff on their lines, so that you may with a nimble touch cast them to and fro at pleasure; then fasten your drawing-cord or hand-lines (of which there must be a dozen at least, and each two yards long) to the upper end of the foremost staves: and so extend them of such a straitness, that with a little strength they may rise up in the nets and cast them over.

Sportsman's Dict.

Your nets being thus laid, place you gigs, or playing-wantons, about 20 or 30 paces beyond, and as much on this side your nets: the gigs must be fastened to the tops of long poles, and turned into the wind, so as they may play to make a noise therein. These gigs are a sort of toys made of long goose-feathers, like shuttle-cocks, and with little small tunnels of wood running in broad and flat swan-quills, made round like a small hoop; and so, with longer strings fastened to a pole, will, with any small wind or air, move after such a manner, that birds will come in great flocks to play about them.

When you have placed your gigs, then place your stale; which is a small stake of wood, to prick down into the earth, having in it a mortice-hole, in which a small and slender piece of wood, about two feet long, is fastened, so as it may move up and down at pleasure: and fasten to this longer stick a small line, which, running through a hole in the stick abovementioned, and so coming up to the place where you are to sit, you may, by drawing the line up and down with your right hand, raise up the longer stick as you see occasion.

Fasten a live lark, or such like bird, to this longer stick, which, with the line making it to stir up and down by your pulling, will entice the birds to come to your net.

There is another stale, or enticement, to draw on these birds, called a *looking glass*; which is a round stake of wood, as big as a man's arm, made very sharp at

Net.

at the end, to thrust it into the ground: they make it very hollow in the upper part, above five fingers deep; into which hollow they place a three-square piece of wood about a foot long, and each two inches broad, lying upon the top of the stake, and going with a foot into the hollowness: which foot must have a great knob at the top, and another at the bottom, with a deep slenderness between; to which slenderness you are to fasten a small packthread, which, running through a hole in the side of the stake, must come up to the place where you sit. The three-square piece of wood which lies on the top of the stake, must be of such a poise and evenness, and the foot of the socket so smooth and round, that it may whirl and turn round upon the least touch; winding the packthread so many times about it, which being suddenly drawn, and as suddenly let go, will keep the engine in a constant rotatory motion: then fasten with glue on the uppermost flat squares of the three-square piece, about 20 small pieces of looking-glass, and paint all the square wood between them of a light and lively red; which, in the continual motion, will give such a reflection, that the birds will play about to admiration until they are taken.

Both this and the other stale are to be placed in the middle between the two nets, about two or three feet distance from each other; so that, in the falling of the nets, the cords may not touch or annoy them: neither must they stand one before or after another; the glass being kept in a continual motion, and the bird very often fluttering. Having placed your nets in this manner, as also your gigs and stales, go to the further end of your long drawing lines and stale lines; and, having placed yourself, lay the main drawing line across your thigh, and, with your left, pull the stale line to show the birds; and when you perceive them to play near and about your nets and stales, then pull the net over with both hands, with a quick but not too hasty motion; for otherwise your sport will be spoiled.

See Plate CCCXLV. where A shows the bodies of the main net, and how they ought to be laid. B, the tail lines, or the hinder lines, staked to the ground. C, the fore lines staked also to the ground. D, the bird stale. E, the looking-glass stale. G, the line which draws the bird stale. H, the line that draws the glass stale. I, the drawing, double lines of the nets, which pulls them over. K, the stakes which stake down the four nether points of the nets and the two tail lines. L, the stakes that stake down the fore lines. M, the single line, with the wooden button to pull the net over with. N, the stake that stakes down the single line, and where the man should sit; and O, the gig.

*Net*, *Neat*, in commerce, something pure, and unadulterated with any foreign mixture.

Thus, wines are said to be *net* when not falsified or balderdashed; and coffee, rice, pepper, &c. are *net* when the filth and ordures are separated from them. See Neat.

A diamond is said to be *net* when it has no stains or flaws; a crystal, when transparent throughout.

Net is also used for what remains after the tare has been taken out of the weight of any merchandise, *i. e.* when it is weighed clear of all package. See Tare.

Thus we say, a barrel of cochineal weighs 450 pounds; the tare is 50 pounds, and there remain *net* 400 pounds.

*Net Produce*, a term used to express what any commodity has yielded, all tare and charges deducted.

The merchants sometimes use the Italian words *netto proceduto*, for net produce.

Netherlands.

NETHERLANDS, anciently called *Belgia*, but since denominated *Low Countries* or *Netherlands*, from their low situation, are situated between 2° and 7° of east longitude, and between 50° and 53° 30′ of north latitude: and are bounded by the German sea on the north, Germany on the east, by Lorrain and France on the south, and by another part of France and the British seas on the west; extending near 300 miles in length from north to south, and 200 miles in breadth from east to west. They consist of 17 provinces; 10 of which are called the *Austrian and French Netherlands*, and the other seven the *United Provinces*.

The greatest part of the Netherlands was conquered by the Romans; and that part which lies towards Gaul continued in their subjection till the decline of that empire; after which the Francs became masters of it; and, under the French monarchy, it was part of the kingdom of Metz or Austrasia.

Towards the end of the 15th century Maximilian of Austria, son of the emperor Ferdinand III. acquired, by marrying the only daughter of the duke of Burgundy, the duchies of Brabant, Limburg, and Luxemburg; the counties of Flanders, Burgundy, Hainault, Holland, Zealand, and Namur; and the lordships of Friesland. Philip of Austria, son to Maximilian and Mary, married Jane the daughter of Ferdinand king of Arragon and of Isabella queen of Castile; by which means their son Charles inherited not only almost all Spain and the great countries then lately discovered in America, but also those noble provinces of the Netherlands, and was chosen emperor under the name of *Charles V.* Towards the latter end of the 1527, he added to his dominions the temporalities of the bishoprick of Utrecht on both sides of the Yssel; and Henry of Bavaria, being distressed through war with the duke of Guelderland, and tired with the continued rebellion of his own subjects, surrendered to the emperor the temporalities of his diocese, which was confirmed by the pope, and the states of the country. In 1536, Charles V. bought of Charles of Egmond the reversion of the duchy of Guelderland and of the county of Zutphen, in case that prince should die without issue. The same year the city of Groningen took the oath of allegiance, and submitted to Charles V. and in 1543 he put a garrison into the city of Cambray, and built a citadel there. Having thus united the 17 provinces, as it were in one body, he ordered that they should continue for ever under the same prince, without being ever separated or dismembered; for which purpose he published in November 1549, with the consent and at the request of the states of all the provinces, a perpetual and irrevocable edict or law, by which it was enacted, that in order to keep all those provinces together under one and the same prince,

Netherlands.

prince, the right of representation, with regard to the succession of a prince or princess, should take place for ever, both in a direct and collateral line, notwithstanding the common laws of some provinces to the contrary. Charles had even a mind to incorporate these provinces with the Germanic body, and to make of them a circle of the empire, under the title of the circle of Burgundy, in order thereby to engage princes of the empire to concern themselves for the preservation of those provinces. But the Netherlands, always jealous of their liberty, did not seem to like that incorporation; and when they were demanded to pay their share towards the expences of the empire, they refused it: whereupon the princes of Germany refused, in their turn, to take any part in the wars in Flanders, and looked upon those provinces as by no means belonging to the Germanic body.

Philip of Austria and his son Charles, who were born in the Netherlands, had for these provinces that natural affection which men use to have for their native country; and, knowing how jealous the inhabitants were of their liberty, and of the privileges granted to them by their former princes, they took great care to preserve them, and suffered willingly that the states, who were the guardians of the people's liberty and privileges, should in a manner share the supreme authority with them. Philip II. son to the emperor Charles V. had not the same affection for the Netherlands, nor those generous sentiments which his father had endeavoured to inspire him with. Being born in Spain of a Portuguese woman, he had no regard but for his native country; and, when he removed out of the Netherlands, he left them to the weak government of a woman, to the proud and haughty spirit of Cardinal de Grenville, and to the wild ambition of some lords of these provinces, who availing themselves of the imprudent conduct and continual blunders of the council of Spain, found their private interest in the disturbances they could not fail to produce. Philip II. also, instead of the mild and moderate measures which his predecessors had successfully employed on many occasions, as best suiting the genius and temper of the people, had recourse to the most violent and cruel proceedings; which, far from curing the evil, served only to exasperate it the more and render it incurable. The Spaniards, whom he sent hither, being born and educated in an absolute monarchy, jealous of the liberties and envious of the riches of the people, broke through all their privileges, and used them almost after the same manner as they had done the inhabitants of their new and ill-gotten dominions in America. This treatment occasioned a general insurrection. The counts Hoorn, Egmont, and the prince of Orange, appearing at the head of it, and Luther's reformation gaining ground about the same time in the Netherlands, his disciples joined the malecontents: whereupon King Philip introduced a kind of inquisition in order to suppress them, and many thousands were put to death by that court, besides those that perished by the sword: for these persecutions and encroachments had occasioned a civil war, in which several battles were fought. The counts Hoorn and Egmont were taken and beheaded: but the prince of Orange, retiring into Holland, did, by the assistance of England and France, preserve Holland and some of the adjacent provinces, which entered into a treaty for their mutual defence at Utrecht in 1579, and they have ever since been styled the *United Provinces*; but the other provinces were reduced to the obedience of Spain by the duke of Alva and other Spanish generals. However, their ancient privileges were in a great measure restored; every province was allowed its great council or parliament, whose concurrence was required to the making of laws, and raising money for the government, though these assemblies were too often obliged to follow the dictates of the court.

Netherlands.

The late emperor Joseph II. endeavoured to deprive them even of the form of their free constitution; and he might very probably have succeeded, had he not attempted at the same time a reformation of the church. The Austrian Netherlands are wholly Catholic, and so bigotted to the Romish superstition, that though they had tamely submitted to many encroachments of the archducal house on their civil right, no sooner did the monarch encroach upon the property of the holy mother church than they resisted his authority, and claimed all their ancient privileges political and religious. The same attachment to their ancient faith and worship made them very lately contribute to expel from their territories the French whom they had invited to relieve them from the Austrian yoke. Thus her religious bigotry for once saved a free people from the iron rod of despotism on the one hand, and the cruelties of frantic democrates on the other. The provinces under the government of France were, till the late revolution, under the same severe arbitrary dominion as the other subjects of that crown, and they now experience the same miseries with the rest of the republic.

The Spaniards continued possessed of almost eight of these provinces, until the duke of Marlborough, general of the allies, gained the memorable victory of Ramillies. After which Brussels the capital, and great part of these provinces, acknowledged Charles VI. (afterwards emperor) their sovereign; and his daughter, the late empress queen, remained possessed of them till the war that followed the death of her father, when the French made an entire conquest of them, except part of the province of Luxemburg; but they were restored by the peace of Aix-la-Chapelle in 1748, and the French retained only Artois, the Cambresis, part of Flanders, part of Hainault, and part of Luxemburg, of which they have had the dominion now upwards of eighty years.

The soil is generally fruitful, but differs in the several parts. The climate also differs in the several provinces; in those towards the south it does not differ much from that of England, though the seasons are more regular. In the northern provinces the winter is generally very sharp, and the summer sultry hot; but the extreme cold and excessive heat seldom continue above five or six weeks. The air is reckoned very wholesome, but is subject to thick fogs in winter, through the moistness of the country, which would be very noxious, were it not for the dry easterly winds, which, blowing off a long continent for two or three months in the year, clear the air, and occasion very sharp frosts in January and February; during which, the ports, rivers, and canals, are commonly

shut

shut up. The face of the country is low and flat; for, except some small hills and a few rising grounds in Utrecht and Guelderland, and in the parts lying towards Germany, there is no hill to be seen in the whole 17 provinces. This is the reason that they have been called the Low Countries. French Flanders abounds in grain, vegetables, flax, and cattle, but is in want of wood.

For the *Dutch Netherlands*, see UNITED *Provinces*.

NETHINIMS, among the Jews, the posterity of the Gibeonites, who were condemned by Joshua to be hewers of wood and drawers of water for the house of God.

NETOPION, a name given by the ancients to a very fragrant and costly ointment, consisting of a great number of the finest spicy ingredients. Hippocrates, in his Treatise of the Diseases of Women, frequently prescribes the netopion in diseases of the uterus; and in other places he speaks of its being poured into the ear as a remedy for deafness; these compositions, by their attenuating qualities, dividing the viscous and thick humours. The word *netopion* is also sometimes used to express the *unguentum Ægyptiacum*, and sometimes simply for oil of almonds.

NETSCHER (Gaspard), an eminent painter, born at Prague in Bohemia in 1639. His father dying while he was an engineer in the Polish service, his mother was obliged, on account of her religion, suddenly to leave Prague with her three sons. When she had proceeded three leagues, she stopped at a castle; which being soon after besieged, two of her sons were starved to death; but she herself found means to escape out of the fortress by night, and to save her only remaining child. Carrying him in her arms, she reached Arnheim in Guelderland, where she found means to support herself, and breed up her son. At length a doctor of physic took young Netscher into his patronage, with the view of giving him an education proper for a physician: but Netscher's genius leading him to painting, he could not forbear scrawling out designs upon the paper on which he wrote his themes; and it being found impossible to conquer his fondness for drawing, he was sent to a glazier, who was the only person in the town that understood drawing. Netscher soon finding himself above receiving any farther assistance from his master, was sent to Deventer, to a painter named *Terburg*, who was an able artist and a burgomaster of the town; and having acquired under him a great command of his pencil, went to Holland, where he worked a long time for the dealers in pictures, who paid him very little for his pieces, which they sold at a high price. Disgusted at this ungenerous treatment, he resolved to go to Rome; and for that purpose embarked on board a vessel bound for Bourdeaux. But his marrying in that city prevented his travelling into Italy; and therefore, returning into Holland, he settled at the Hague; where observing that portrait-painting was the most profitable, he applied himself solely to it, and acquired such reputation, that there is not a considerable family in Holland that has not some of his portraits; and besides, the greatest part of the foreign ministers could not think of quitting Holland without carrying with them one of Netscher's portraits, whence they are to be seen all over Europe. He died at the Hague, in 1684; leaving two sons, Theodore and Constantine Netscher, both of them good portrait painters.



NETTINGS, in a ship, a sort of grates made of small ropes seized together with rope yarn or twine, and fixed on the quarters and in the tops; they are sometimes stretched upon the ledges from the waste-trees to the roof trees, from the top of the forecastle to the poop, and sometimes are laid in the waste of a ship to serve instead of gratings.

NETTLE, in botany. See URTICA.

*Sea* NETTLE. See MEDUSA and *Animal-Flower*.

NETTLE-*Tree*. See CELTIS.

NETTUNO, a handsome town of Italy, in the Campagna di Roma. It is but thinly peopled, though seated in a fertile soil. The inhabitants are almost all hunters. E. Long. 12. 57. N. Lat. 41. 30.

NEVA, a river at Petersburgh, in Russia. The views upon the banks exhibit the most grand and lively scenes. The river is in most places broader than the Thames at London. It is deep, rapid, and transparent as crystal, and its banks are lined on each side with a continued range of handsome buildings. On the north side the fortress, the academy of sciences and that of art are the most striking objects; on the opposite side are the imperial palace; the admiralty, the mansions of many Russian nobles, and the English line, so called because (a few houses excepted) the whole row is occupied by the English merchants. In front of these buildings, on the south side, is the quay, which stretches for three miles, except where it is interrupted by the admiralty; and the Neva, during the whole of that space, has been lately embanked at the expence of the empress by a wall, parapet, and pavement of hewn granite; a most elegant and durable monument of imperial munificence. There is a communication between the opposites sides of the river by a bridge of pontoons, which, when any thing is apprehended from the force of ice rushing down the stream, can be, and is generally indeed, removed. The great depth of the river, it appears, prevents the building of a stone bridge; and, if it could be built, there is no reason to suppose it could possibly resist the force of those vast shoals of ice which in the beginning of winter come down this rapid river. An attempt, however, has been made to remedy this inconvenience; and a Russian peasant has actually projected the plan of throwing a wooden bridge of one arch across it, which in its narrowest part is 980 feet in breadth. As we think this is a matter of very considerable importance, as well as of curiosity, we shall give the following copious account of the plan and its author, in Mr Coxe's own words; who tells us that the artist had then executed a model 98 feet in length, which he saw and examined with considerable attention.

"The bridge is upon the same principle with that of Shaffhausen, excepting that the mechanism is more complicated, and that the road is not so level. I shall attempt to describe it by supposing it finished, as that will convey the best idea of the plan. The bridge is roofed at the top, and covered at the sides; it is formed by four frames of timber, two on each side, composed of various beams or trusses, which support the whole machine. The road is not, as is usual, carried over the top of the arch, but is suspended in the middle.

"The following proportions I noted down with

Neva.

the greatest exactness at the time when they were explained to me by the artist.

| | |
|---|---|
| Length of the abutment on the north end, | 658 feet. |
| Span of the arch, - - - | 980 |
| Length of the abutment on the south end, | 658 |
| Length of the whole structure, including the abutments, - - | 2296 |
| The plane of the road upon its first ascent makes an angle of five degrees with the ordinary surface of the river. | |
| Mean level of the river to the top of the bridge in the centre, - | 168 |
| Ditto to the bottom of the bridge in the centre, - - | 126 |
| Height of the bridge from the bottom to the top in the centre, - - | 42 |
| Height from the bottom of the bridge in the centre to the road, - | 7 |
| Height from the bottom of ditto to the water, - - | 84 |
| Height from the water to the spring of the arch, - - - | 56 |

So that there is a difference of 35 feet between the road at the spring of the arch and the road at the centre; in other words, an ascent of 35 feet in half 980, or in the space of 490 feet, which is little more than eight-tenths of an inch to a foot. The bridge is broadest towards the sides, and diminishes towards the centre.

| | |
|---|---|
| In the broadest part it is - | 168 feet. |
| In the centre or narrowest - | 42 |
| The breadth of the road is - | 28 |

"The artist informed me, that to complete the bridge would require 49,650 iron nails, 12,908 large trees, 5500 beams to strengthen them, and that it would cost 300,000 roubles, or 60,000l. He speaks of this bold project with the usual warmth of genius; and is perfectly convinced that it would be practicable. I must own that I am of the same opinion, though I hazard it with great diffidence. What a noble effect would be produced by a bridge striking across the Neva, with an arch 980 feet wide, and towering 168 feet from the surface of the water? The description of such a bridge seems almost chimerical; and yet upon inspection of the model we become reconciled to the idea. But whether the execution of this stupendous work may deemed possible or not, the mordel itself is worthy of attention, and reflects the highest honour on the inventive faculties of that unimproved genius. It is so compactly constructed, and of such uniform solidity, that it has supported 3540 pood, or 127,440 pounds, without having in the least swerved from its direction, which I am told is far more, in proportion to its size, than the bridge if completed would have occasion to sustain from the pressure of the carriages added to its own weight.

Neva || Nevers.

"The person who projected this plan is a common Russian peasant. This extraordinary genius was apprentice to a shopkeeper at Nishnei Novogorod: opposite to his dwelling was a wooden clock, which excited his curiosity. By repeated examinations he comprehended the internal structure, and without any assistance formed one exactly similar in its proportion and materials. His success in this first essay urged him to undertake the construction of metal clocks and watches. The empress, hearing of these wonderful exertions of his native genius, took him under her protection, and sent him to England; from whence, on account of the difficulties attending his ignorance of the language, he soon returned to Russia. I saw a repeating watch of his workmanship at the Academy of Sciences: it is about the bigness of an egg; in the inside is represented the tomb of our Saviour, with the stone at the entrance, and the centinels upon duty: suddenly the stone is removed, the centinels fall down, the angels appear, the women enter the sepulchre, and the same chant is heard which is performed on Easter-eve. These are trifling, although curious performances; but the very planning of the bridge was a most sublime conception. This person, whose name is *Kulibin*, bears the appearance of a Russian peasant; he has a long beard, and wears the common dress of the country. He receives a pension from the empress, and is encouraged to follow the bent of his mechanical genius (A)."

NEVEL, or NEBEL, in the Jewish antiquities, a kind of musical instrument. See NABLUM. Plate CCCXLIV

NEVERS is the capital of the Nevernois in France, and government of Orleanois. It is situated in E. longitude 3. 15. N. latitude 46.50. on the river Loire, which here receives the rivulet *Nievre*, from which this city derives its name. It is a place of great antiquity, supposed to be Cæsar's Noviodunum in Æduis, where he erected magizines for his armies. Francis I. made it a duchy and peerage in 1521, in favour of Francis of Cleve, to whom it came by marriage. It devolved afterwards to the house of Mantua, and then to the Palatine family, who 1651 sold it to Cardinal Mazarine. The cardinal obtained a title of duke and peer for his nephew Philip Mancini, in whose family it continued till the late revolution, though it is impossible, in the present unsettled state of France, to say whose property it may be now. The town is fortified with walls, defended with many high towers and deep ditches, and is the seat of a bishopric, suffragan of Sens, as likewise of a bailiwic and chamber of accounts.



(A) We have given this detail in Mr Coxe's own words, as it appears to us to deserve attention on acconnt of the greatness of the project, which would have excited admiration had it been attempted by one enlightened by science and liberal arts, much more when it comes through the humble medium of a Russian peasant. It was never executed, as we are just informed by a gentleman who left St Petersburgh about the beginning of June 1793; but the model remains, and is still shown. The same gentleman (we quote his own words) adds, "that every mechanic thinks it practicable; and that the general belief is, that the empress would have built it, had she not found use for all her money in carrying on her warlike and diplomatic transactions with other courts."

Nevers, Neuchattel. counts. There is a stone bridge on the Loire, with twenty arches, a draw-bridge on each side, and towers to defend them. The cathedral is dedicated to St Cyr. There are eleven parishes in the town, and a great many religious houses. The Jesuits college near the gate des Ardeliers is a handsome structure. The palace of the dukes of Nevers has a large front between two great towers, with a court on one side and a garden on the other. Here it was that John Casimir king of Poland died the 16th of December 1672. Near this palace stands the convent of Cordeliers, who have a magnificent church, in which the tombs of duke John and Catharine of Bourbon on the right, and those of Lewis of Gonzaga duke of Nevers, and Henrietta of Cleves his wife, merit attention.—— This town is famous for its glass-manufacture and earthen ware, and is said to contain about 8000 inhabitants.

In the centre of Nevers, on the summit of a hill, is built the palace of the ancient dukes. It appears to have been constructed in the sixteenth century, and, though beginning to exhibit marks of decay, is yet a model of the beauty and delicacy of the Gothic architecture. The apartments are hung with tapestry of 200 years old, which have an air of grotesque and rude magnificence. There is in one of the chambers a portrait of Madame de Montespan, who appears rising from a superb couch, the curtains of which are drawn back, and supported by Cupids. Her attitude is half voluptuous, half contemplative. She is dressed in a negligent dishabille, and her hair floats down over her shoulders and neck in waving ringlets. Her head rests on her left hand, and one of her feet is concealed by her robe; the other, which is naked to the mid-leg, and on which the painter with great taste, has exhausted all his art, is placed on an embroidered cushion. Her slippers are thrown carelessly by.

NEUCHATTEL, a tolerably handsome town of Swisserland, capital of a county of the same name. There are several ancient ruins near it, which show its former extent; and there are two large churches, besides a castle where the governor resides. The town contains about 3000 inhabitants. It is situated partly on a small plain, between Mount Jura and the lake of Neuchattel, which is 17 miles long and five broad; the side of the harbour is the usual walk of the inhabitants. Part of it too is built upon the side of the mountain; whence some of its streets are very steep. In this small place several public works have lately been executed, which Mr Coxe thinks are far beyond the revenues, or even the wants, of such a little state. Among these he instances a superb causeway and a town-house "built (says he) of such solid materials as if it was intended to survive to the most distant posterity, and to rival the duration of the much-famed Roman capitol." At the beginning of the present century, commerce was very little followed in this town, owing to an absurd opinion which prevailed among the inhabitants of its being disgraceful; but this prejudice is now extinguished, and the town in a much more flourishing situation than before. The chief article of exportation is wine, which is much esteemed; and manufactures of printed linens and cotton have been established with considerable success. The flourishing state of Neuchattel is principally owing to the benefactions of Mr David Pury, late banker of the court at Lisbon. He was born at Neuchattel in 1709; but having received his education there, he quitted it in great poverty and repaired to Geneva, where he served his apprenticeship, but in what line is not mentioned. From Geneva he went to London, where he acted as clerk to a dealer in precious stones, and acquired great reputation by estimating the value of diamonds at sight. After a long residence in England he went to Lisbon, where he carried on a very extensive commerce: and having been appointed court-banker, his fortune rapidly increased. His generosity, however, kept pace with his wealth; and he not only remitted large sums to Neuchattel while living, but left his country his heir when he died. His contributions in all are estimated by Mr Coxe at 200,000l.; a considerable part of which has been employed in constructing the public works already mentioned. Mr Coxe hints, that notwithstanding the superb edifices already mentioned, there are many conveniencies still wanting to render Neuchattel agreeable; the public walks, for instance, might be greatly improved; the streets, which are very dirty, might be kept clean; and a torrent which runs through the town, and frequently threatens it with inundations, might be turned. Encouragement ought also to be given to literature; for our author observes, that the inhabitants of Neuchattel are much more ignorant than those of other parts in Swisserland, which no doubt is in a great measure owing to their having not a single seminary of learning which deserves the name in the place. It has a grand and little council: the first is composed of 40 persons, with two masters of the keys; the little council consists of 24 members, comprehending the mayor, who is president. These two councils assemble regularly every month. The ecclesiastics likewise assemble every month, to consult on affairs belonging to the church, and to fill up the places of ministers that die. They choose a dean every year, who is president of the general assemblies, which are called *classes*; and sometimes he is confirmed in this dignity. E. Long. 7. 10. N. Lat. 47. 5.

NEUCHATTEL, a sovereign county of Swisserland, bounded on the west by the Franche Compte, on the north by the bishopric of Basle, and on the east and south by the cantons of Berne and Friburg. This principality of Neuchattel and Vallengin extend from the lake of Neuchattel to the borders of Franche Compte, being in length about 12 leagues, and six in breadth. The plain with the lower part of the mountains is occupied by the district of Neuchattel, but Vallengin is totally enclosed by Jura. Parallel chains of these mountains run from east to west, forming several valleys in the most elevated parts. The lower grounds of this chain consist of arable lands and vineyards; the higher of large tracts of forest, which in many parts have been cleared and converted into pasture grounds, intermixed with fields of barley and oats. The inhabitants are numerous, and remarkable for their genius, politeness, and active industry. It contains three cities, one town, 90 villages, and about 300 houses dispersed in the mountains. The inhabitants are all Protestants, except two Roman catholic villages: and in 1529 they entered

Neuchattel. tered into a strict alliance with the cantons of Berne, Friburg, Soleure, and Lucern. The air is healthy and temperate, but the soil not everywhere equally fertile: however, there are large vineyards, which produce white and red wine, which last is excellent. The pastures on the mountains feed a great number of all sorts of cattle; and there are plenty of deer in the forests; besides large trouts, and other good fish, in the lakes and rivers. The mildness of the government, and agreeable situation of the inhabitants in general in these districts, is evident from the great increase of population in the space of 32 years. In 1752 they contained only 28,017 subjects and 4318 aliens: but in 1784 the number was augmented to 31,576 subjects and 9704 aliens; being an increase of near a fourth part in that time. The facility with which the burghership of Neuchattel is acquired, may also be accounted one of the means of augmenting its population; for between the years 1760 and 1770, the magistrates admitted 41 persons to this privilege; from 1770 to 1780, 46; from 1780 to 1785, 51; in all 138; many of whom had children before they purchased their burghership, and 38 of them were foreigners, either German, French, or Dutch.

The districts of Neuchattel and Vallengin now make part of the Prussian dominions. It had its own counts for a long time; the last of whom dying in 1694 without issue, it came to Mary of Orleans duchess of Nemours, his only sister, who also died without issue in 1703. There were then 13 competitors, among whom was Frederick I. king of Prussia, who claimed as heir to the prince of Orange. His right was acknowledged by the states of the country in 1707; but in this part of his dominions the Prussian monarch is far from having such an absolute authority as in others. On the accession of Frederick I. some general articles were agreed on, by which the prerogatives of the prince and the rights of the people were settled. Disputes, however, occurred betwixt the king and his subjects, which were not thoroughly settled till the year 1768, when the general articles were not only renewed, but explained wherever their tenor had been mistaken, confirming also several privileges in favour of the people which had hitherto been equivocal or not duly observed. The most important of these general articles were, 1. The establishment of the reformed religion, and the toleration of no other, except in two places where it was already prevalent. 2. No civil or military office to be possessed by foreigners, that of governor only excepted. 3. All subjects have a right to enter into the service of a foreign prince not actually at war with the king as sovereign of Neuchattel; the state may also continue neuter when the king is engaged in wars which do not concern the Helvetic body. 4. The proper administration of justice; for which the three estates of Neuchattel and Vallengin shall be annually assembled. 5. The magistrates to hold their places during good behaviour; but of this certain persons appointed at Neuchattel, and not the king, are to judge. 6. The sovereign, on his accession, shall take an oath to maintain the rights, liberties, and customs of the people, *written* and *unwritten*.

This last article is no less important than it is singular; for upon an unwritten custom one of their most essential privileges depends; viz. that the sovereign shall be considered only as resident at Neuchattel. "Now (says Mr Coxe), this privilege, in conjunction with the third article just cited, forms the basis of their civil liberty. By the former, the prince, when absent, can only address his subjects through his governor and the council of state; and no subject can be tried out of the country, or otherwise than by judges appointed by the constitution: by the latter, should the king of Prussia be at war with all Germany, the people of Neuchattel and Vallengin are by no means obliged to arm in his defence; but individuals may even serve against him, as long as the powers whom they serve are not engaged in any hostilities against their own country." A remarkable instance of this last our author gives in the following anecdote. "When Henry duke of Longueville, and sovereign of Neuchattel was, in 1650, sent to the castle of Vincennes, Felix de Mareval, captain of the Swiss guards, kept guard in his turn, though he was citizen of Neuchattel, at the door of the prison where his sovereign was confined."

The king confers nobility, names the principal officers of state, appoints the presidents of the courts of justice called *chatelins* and *mayors;* but his revenues scarcely amount to 5000l. a-year. They arise from certain demesnes; from a small land-tax, the tythes of wine and corn, and a tenth part of the value of all immoveables. No subject pays any duty upon goods either exported or imported, except for foreign wines brought into the town itself.

Neuchattel enjoys very considerable privileges, has the care of the police within its own district, and is governed by its own magistracy consisting of a great and little council. The three estates of the country form the supreme tribunal, and receive appeals from the inferior court of justice. They consist of 12 judges divided into three estates: the judges in the first and second division hold their places for life; but those in the third are chosen annually. The estates usually meet once a-year in the month of May, but are convoked extraordinarily upon particular occasions, and the town of Neuchattel is always the place of meeting. They are not, however, the representatives of the people, nor do they possess any legislative authority. Properly speaking, they are the supreme court of judicature, which receives all appeals, and decides finally upon all causes, even those which relate to the sovereignty of the country, of which we have an example in the revolution of 1707. The ordinary administration of government is vested in the council of state, which superintends the general police, and is the medium by which the sovereign exercises his jurisdiction. The members are nominated by the king, and are not restricted to any number, but he is always considered as personally presiding in the assembly; and the president has no other powers than those of convoking the assembly, proposing the subjects of consideration, collecting the votes, and deciding when the voices are equal. The ordinances of this council are previously communicated to the *ministraux* of Neuchattel, who must certify that they contain nothing contrary to law. The ministraux are a kind of committee from the council of the town, and are intrusted with the administration of the police. They consist

sist of the two presidents of that council, four master burghers taken from the little council, and the *banneret* or guardian of the liberties of the people. The former six are changed every two years; and the banneret is chosen by the general assembly of the citizens, and continues in office during six years.

When the causes are decided in the month of May by the three estates, the four judges, who form the third estate, retire, and their place is supplied by the four ministraux. The attorney general then desires the members of the three estates to take into consideration whether it is necessary to frame any new laws. If a new ordinance is proposed, a declaration is drawn up and delivered to the council of state for their deliberation, whether it be contrary to the prerogatives of the prince or the rights of the subject; from thence it is communicated to the council of the town in order to be examined, whether it infringes the privileges of the citizens. If adopted by the council of state and the council of the town, it is proposed to the prince for his approbation or rejection: in the former case it is again publicly read before the three estates, and the governor or president declares the approbation of the sovereign. It is then promulgated, or passed into a law by the three estates. The people of Valiengin have always been consulted upon the framing a new law since the accession of the house of Brandenburg. For this purpose the three master burghers of Vallengin examine, whether it contains any thing inconsistent with the franchises of that district; in which case they have the power of remonstrating to the governor in council. Every year, at the conclusion of the assembly of the estates of Neuchattel, those of Vallengin, as constituting the supreme court of judicature for that country, meet at Vallengin, and decide finally all appeals from the inferior courts of justice. Both principalities are divided into a certain number of districts, each of which has its criminal court of justice. Every criminal is brought to trial immediately after he is arrested, and sentence is read to him in prison. Next morning he appears again before the judges, assembled in the open air; the former proceedings on the trial are read, and the judges once more deliver their opinion. In capital sentences the governor is immediately made acquainted with the circumstances of the case; and if he does not mitigate the sentence, it is put in execution without delay. Torture, though seldom used, is not entirely abolished in these districts. Great circumspection, however, is made use of in judicial proceedings, "which (says Mr Coxe) may sometimes favour the escape of the criminal; but the few instances of atrocious crimes prove that this humane caution is no encouragement to transgressions, and is a strong presumption of the general good morals which prevail among the people. In a word, personal liberty is almost as tenderly and as securely protected by the laws of this country as by those of our own invaluable constitution. Thus the liberties of the people are as well and perhaps better secured, than even in the democratical cantons; for although the most despotic prince in Germany is sovereign, his power is exceedingly limited. Among the striking circumstances which characterize this goverment, must be mentioned the very liberal encouragment given to strangers who settle in the country. They enjoy every privilege of trade and commerce; and in no state are fewer essential distinctions made between strangers and natives."



NEUFCHATTEAU, a town of France, in Lorrain, and capital of the chatellany of Chatenoi. It is a handsome, populous, trading town; having an abbey of the nuns of St Clair, a commandery of Malta, and several convents of monks and nuns. It is seated in a bottom, in a soil fertile in corn, wine, and all the necessaries of life, on the river Mouzon. E. Long. 5. 45. Lat. 48. 20.

NEVIS, one of the Caribbee islands, lying about seven leagues north of Montserrat, and separated from St Christopher's by a narrow channel. It makes a beautiful appearance from the sea, being a large conical mountain covered with fine trees, of any easy ascent on every side, and entirely cultivated. The circumference is about 21 miles, with a considerable tract of level ground all around. The climate in the lower part is reckoned to be warmer than Barbadoes, but it is more temperate towards the summit. The soil is very fine in the lower part, but grows coarser as we ascend. The productions are nearly the same with those of St Christopher. There are three pretty good roads or bays, with small towns in their vicinity; Charles Town, Moreton Bay, and Newcastle. This pleasant island was settled under the auspices of Sir Thomas Warner from St Christopher's. His successor, Governer Lake, was considered as the Solon of this little country, in which he disposed of every thing with such prudence, wisdom, and justice, as procured him an high reputation with the French as well as English. In the Dutch war they met with some disturbance from the French; but by being covered by an English squadron, the enemy were obliged to desist from their intended invasion, after a smart engagement in sight of the island. Sir William Stapleton sometimes resided here, and Sir Nathaniel Johnson constantly, at which time the inhabitants of Nevis were computed at 30,000. In the war immediately after the revolution, they exerted themselves gallantly, and had two regiments of 300 men each. In that of Queen Anne they behaved equally well, though they were less fortunate; for the French landing with a superior force, and having inveigled most of their slaves, they were forced to capitulate. About 4000 of these slaves the French carried away and sold to the Spaniards, to work in their mines. The parliament, after making due inquiry into the losses they had sustained, voted them about a third part of the sum in which they had suffered. These losses by war, an epidemic disease, and repeated hurricanes, exceedingly diminished the number of the people. They are now thought not to exceed 2000 or 3000 whites, and 6000 blacks. There is here a lieutenant governor, with a council, and an assembly, which is composed of three members from each of the five parishes into which the island is divided. The commodities are cotton and sugar; and about 20 sail of ships are annually employed in this trade.

NEURADA, in botany: A genus of the decagynia order, belonging to the decandria class of plants; and in the natural method ranking under the 13th order, *Succulentæ*. The calyx is quinquepartite; there are five petals; the capsule inferior, decemlocular, decaspermous,

mous, and aculeated. There is only one species, the *procumbens*. The whole plant is white and woolly: it sends off numerous stalks in every direction, which lie flat on the ground: the leaves stand on short footstalks; they are of an oval shape, and plaited like those of the *ladies mantle*. It is a native of the warm climates, and found on dry parched grounds.

NEURITICS, in pharmacy, medicines useful in disorders of the nerves.

NEUROGRAPHY, signifies a description of the nerves. See ANATOMY, N° 136.

NEUROPTERA. See ZOOLOGY.

NEUTER, a person indifferent, who has espoused neither party, and is neither friend nor foe.

A judge ought to be neuter in the causes he judges; in questions, where reason appears neuter, a man should ever incline to the side of the unhappy.

NEUTER, in grammar, denotes a sort of gender of nouns, which are neither masculine nor feminine. See GENDER.

The Latins have three kinds of genders, masculine, feminine, and neuter. In English, and other modern tongues, there is no such thing as neuter nouns. See NOUN.

*Verbs* NEUTER, by some grammarians called *intransitive verbs*, are those which govern nothing, and that are neither active nor positive. See VERB.

When the action expressed by the verb has no object to fall upon, but the verb alone supplies the whole idea of the action; the verb is said to be *neuter*: as, I sleep, thou yawnest, he sneezes, we walk, ye run, they stand still.

Some divide verbs neuter into, 1. Such as do not signify any action, but a quality; as *albet*, "it is white;" or a situation, as *sedet*, "he sits;" or have some relation to place; as *adest*, "he is present;" or to some other state or attribute, as *regnat*, "he rules," &c. And, 2. Those that do signify actions, though those such as do not pass into any subject different from the actor; as to dine, to sup, to play, &c.

But this latter kind sometimes cease to be *neuter*, and commence active; especially in Greek and Latin, when a subject is given them: as, *vivere vitam, ambulare viam, pugnare pugnam*. Thus the old French poets say, *Soupirer son tourment*; the English, to *sigh his woes*, &c.

But this is observed only to obtain where something particular is to be expressed, not contained, in the verb: as, *vivere vitam beatam*, to live a happy life; *pugnare bonam pugnam*, to fight a good fight, &c.

According to the abbot de Dangeau, *verbs neuter* may be divided into *active* and *passive*; the first, those that form their tenses in English, by the auxiliary verb *to have*; in French, by *avoir*. The second, those that form them in English with the verb *to be*; in French *être*.—Thus, to sleep, to yawn, *dormir* and *eternuer*, are *neuters active*.—To come, and to arrive, are *neuters passive*.

*NEUTRAL Salts*, among chemists, those compounded of an acid with any other substance capable of uniting with it and destroying its acidity. Those in which the acid is saturated with an earth or a metal are called *imperfect*, but those in which a pure alkali is employed are called *perfect* neutrals.



NEUTRALITY, the state of a person or thing that is neuter, or that takes part with neither side.

NEW ABBEY, situated near Kilcullen bridge, in the county of Kildare, and province of Leinster, in Ireland. It was founded by Rowland Eustace, of a great and ancient family in this county; the tower is still standing, and some part of the abbey; the ruins of the rest have contributed to build several dwellings near it. In the inside Rowland Eustace and his lady lie buried; their figures, clothed in armour, are to be seen there. Near this is a handsome seat of the Carter family, on the opposite side of the river Liffey.

NEWARK *upon Trent*, in the county of Nottingham, is a great thoroughfare in the York road, 124 miles from London. It has bridges over the Trent, which forms an island here, by dividing itself into two streams two miles above the town, which meet again two miles below it. A magnificent castle was built here in the reign of King Stephen, which held out stoutly in the barons wars for King John, who died here, October 19. 1216; and it also stood out for King Charles I. to the last; but after he had put himself into the hands of the Scots army then before it. the governor by his order surrendered it, after which it was demolished.—It was situated near the river; the walls of the towers are very thick, and of a very great height; and were there no historical testimony, these remains are sufficient evidence that it was formerly of great importance. In the court before these ruins is a very fine bowling green, and near it a manufactory of sacking. The town being subject to inundations from the river Trent, and often from that circumstance made impassable, a turnpike road, at the instigation of a publican, was made about twenty years ago, so high as to be passed with safety in the greatest floods, by arches of brick being made in several places to carry off the water, constructed by Mr Smeaton, at the expence of 12,000l. Near the town there is a bridge constructed for the same purpose, made mostly upon dry land, consisting of nine arches. It has a neat though small new street, and a market place that is handsome, though not very spacious. Its church, which is reckoned one of the finest in the kingdom, was built by Henry VI. and has a lofty spire. It was incorporated by King Charles II. with a mayor and 12 aldermen.—The same king, in gratitude to the town for its loyalty to his father, gave it the privilege of sending members to parliament. It has a good trade in corn, cattle, wool, &c. and has a charity school for 36 boys. Its market is on Wednesday; fairs on the Friday before Passion-Sunday, May 14th, Whit-Tuesday, August 12th, Nov. 1st, and Monday before December 11th. Here was an abbey of Augustine friars. A free school was founded here, endowed with the lordship of Everton in this county; and the vicar of Newark, and the brethren of the Trinity-guild for the time being, who were then the chief governors of this town, were made perpetual trustees for this foundation. Many Roman urns and other antiquities have been found about this town, from whence it has been supposed that they had some town in the neighbourhood.

NEWBOROUGH, or NEWBURGH, in the Isle of Anglesey, North Wales, distant from London 254 miles, though but a small town, situated over against Caernarvon in North Wales, about 17 miles south-

west.

Newburg

Newcaſtle

weſt from Beaumaris; is governed by a mayor, two bailiffs, and a recorder. Its Welſh name is *Rhôſſir*, or *Rhoſvair*. Its weekly markets, which are pretty well ſupplied with proviſions, are kept on Tueſdays; and its annual fairs on the 22d of June, Aug. 10th and 21ſt, Sept. 25th, and Nov. 11th.

NEWBURG, the name of ſeveral towns of Germany, two of which are the chief towns of duchies of the ſame name; one in Bavaria, and the other in the Palatinate.

NEWBURY, a town in the county of Berks in England, 16 miles from Reading, and 56 from London, aroſe on the decay of Spinham-Land. Notwithſtanding its name ſignifies *New-Borough*, it is as old almoſt as the Conqueſt. It made ſo much broad cloth formerly, that in the reign of Henry VIII. here flouriſhed John Winſcomb, commonly called *Jack of Newbury*, one of the greateſt clothiers that ever was in England, who kept 100 looms in his houſe; and in the expedition to Flowden Field againſt the Scots, marched with 100 of his own men, all armed and clothed at his own expence; and he built all the weſt part of the church. Alſo Mr Kenric, the ſon of a clothier here, though afterwards a merchant in London, left 4000l. to the town, as well as 7500l. to Reading, to encourage the woollen manufactory. It makes a great quantity of ſhalloons and druggets, but not near ſo much broad cloth now as formerly; yet it is a flouriſhing town, with ſpacious ſtreets, and a large market place, in which is the guild-hall. The church is a good one, of ſtone, ſuppoſed to have been built about 1640. It has ſeven ſets of alms houſes. In the neighbourhood, on the banks of the Kennet, there is a ſtratum of petrified wood dug out for firing, when they frequently find trunks of large oaks yet undecayed, with petrified hazel nuts, fir cones, &c. with the bones and horns of ſtags, antelopes, &c. tuſks of boars, and heads of beavers. The river Kennet, which abounds with excellent trout, eels, and cray-fiſh, runs through the town; and here is plenty of all other proviſions. It was made a corporation by Queen Elizabeth, and is governed by a mayor, high ſteward, aldermen, &c. It ſends a great quantity of malt to London, has good inns, and has a charity-ſchool for 40 boys. Its market, which is well ſupplied with corn, is on Thurſdays; and fairs on Holy-Thurſday, July 5th, Aug. 24th, and Oct. 28th.

NEWCASTLE-*Under-Line*, a town in England, in the county of Stafford, on a branch of the Trent, is 15 miles north of Stafford, 33 ſouth ſouth-eaſt of Warrington, and 149 from London; had a caſtle, now in ruins; and is ſo called from an older caſtle, which formerly ſtood two miles off, at Cheſterton-Under-Line. It was incorporated by King Henry I, and again by Queen Elizabath and King Charles II. and is governed by a mayor, two juſtices, two bailiffs, and 24 common council. The clothing trade flouriſhes here; but its chief manufactory is hats, here being an incorporated company of felt makers. The ſtreets are broad and well paved, but moſt of the buildings low and thatched. The market is on Mondays; fairs [illegible] Eaſter Monday, Whit-Monday, July 6th, firſt [illegible]day in September, and November 6th, for cattle. [illegible] alſo a great beaſt-market every other Mon-[illegible] The corporation has a court, which holds pleas for actions under 40l. Its caſtle, of which there is little to be now ſeen, was built in the reign of Henry III. It had four churches formerly, which are now reduced to one, the town having ſuffered much in the barons wars. There are frequent horſe races in the neighbourhood, though it is in a manner ſurrounded with coal pits; particularly one at Hamley-Green. It is ſofter than the cannel coal, and is cut out in ſlices; but conſumes ſo faſt, that it is only fit for forges. There is the greateſt quantity of ſtone ware made near this place of any part of England; ſo that one year with another, they are ſaid to export 20,000l. worth of it.

Newcaſtle.

NEWCASTLE, the capital of the county of Northumberland in England, 14 miles north of Durham, 94 north of York, 63 ſouth by eaſt of Berwick, 60 eaſt of Carliſle, and 271 from London, ſtands at the end of the Picts wall, on the north ſide of the Tyne, over which it has a ſtately bridge into the biſhopric of Durham, in which its ſuburb called *Gateſide* is ſituated; for the liberties of Newcaſtle extend no farther than the great iron gate upon the bridge, which has the arms of the biſhop of Durham carved on the eaſt ſide and thoſe of Newcaſtle on the weſt ſide. It is admitted to have been a Roman ſtation, though no evidence at preſent appears, except at Pandon-gate, whoſe ſuperſtructure is of different workmanſhip and model from any others of the town, the arches being circular. The Carpenter's tower is alſo of Roman original. In the Saxons time it was called *Moncaſter*, from the monks here, who all fled when it was depopulated by the Danes; and afterwards *Newcaſtle*, from a caſtle built here by William the Conqueror's ſon, Robert, in 1080, to defend the country againſt the Scots, whoſe kings had this town before the Norman conqueſt, and ſometimes reſided here.—Several monaſteries and houſes were built here ſoon after the caſtle; and it was greatly enlarged and enriched by a good trade to the coaſts of Germany, and by the ſale of its coal to other parts of England; for which, and for other merchandiſe, it is become the great emporium of the north of England, it being the neateſt and largeſt [illegible] thoſe parts, next to York. In the reign of Edward I. it was burnt by the Scots; but a very rich burgher who was taken priſoner, ſoon ranſomed himſelf for a good ſum of money, and began the firſt fortifications of the place, which he extended from Sand-gate to Pampedon, and thence to the Auſtin friars gate; which the townſmen finiſhed, and encompaſſed with ſtout walls, which extended two miles, wherein are ſeven gates and many turrets, with ſeveral caſements bomb-proof. To which two other gates were added in more modern times, viz. Bridge-gate and Sand-gate: the wall between them was afterwards removed to open the quay. Edward III. granted the corporation the duties and cuſtoms of the town for ſeven years, to enable them to complete the fortification. It is a borough at leaſt as ancient as King Richard II. who granted that a ſword ſhould be carried before the mayor; and King Henry VI. made it a town and county incorporate of itſelf, independent of Northumberland. Henry VII. built a monaſtery here for the Franciſcans. Beſides which, it had ſeveral religious foundations, ſeveral of which ſtructures have been converted to companies halls and private reſidences,

Newcastle. residences. In the reign of Henry VIII. this place is said to have exceeded in the strength and magnificence of its works all the cities of England, and most places in Europe. The town is governed by a mayor, 12 aldermen, a recorder, sheriff, town clerk, a clerk of the chambers, two coroners, eight chamberlains, a sword bearer, a water bailiff, and seven serjeants at mace. Its situation, especially the most busy part of it towards the river, is very uneven, it being built on the declivity of a steep hill, and the houses very close. The castle overlooks the whole town. That part built by Robert was of great strength, and square, and surrounded by two walls; the square was 62 feet by 54, and the walls 13 feet thick, within which was a chapel. The outward fortifications are now defaced, and their site crowded with buildings. The tower remains entire, and situated on a lofty eminence, and its principal entrance is to the south. This castle belongs to the county, and makes no part of the liberties.—It is now the county prison, and in the great hall the judges hold the assizes. Here Baliol king of Scotland did homage to King Edward I. in 1292; as did Edward Baliol in 1334 to King Edward III. Here is a magnificent exchange and a customhouse; and the finest quay in England, except that at Yarmouth, being 700 yards long, it being far more spacious and longer than those at London or Bristol, though not equal to either for business. There is a handsome mansion house for the mayor, who is allowed 1000l. a-year for his table, besides a coach and barge. The old bridge was carried away in a flood, and the present was erected about 1775, of nine noble elliptic arches. With the old bridge 22 houses were thrown down, and six lives lost. It was originally built of wood; but having been destroyed by fire in 1248, was rebuilt of stone, and consisted of 12 arches, three of which on the north side were closed up, and served for cellars; this was again rebuilt about 1450, and was crowded with wooden buildings; but near the middle was a tower with an iron gate, used as a town prison. A strong building crossed the bridge, which was used as a magazine. On the south front was a statue of King Charles II. [illegible]er which destroyed this bridge, on November 11, 1771, was upwards of 12 feet above high water mark in spring tides.—On destroying the ruinated piers of the old bridge to erect the present, by observations made, and medals found, part of it is supposed to have existed from the time of the Romans. It is computed that above 6000 keelmen are employed here, who have formed themselves into a friendly society; and, by their own contributions, built a noble hospital containing 50 chambers, for such of their fraternity as are poor, disabled, or past their labour; and it is supported by the contribution of those that are in health. The town is extremely populous; and, notwithstanding the multitude of those employed in and about the coal pits, with which the town is in a manner surrounded, has abundance of poor; but it has also many wealthy inhabitants, and it is said they pay above 4000l. a-year to their relief. It is observed, that this town has the greatest public revenue in its own right as a corporation, of any town in England, it being computed at no less than 8000l. a-year. In 1774, the receipts of the corporation were 20,360l. 9s. 8d.; and their disbursements about 19,445l. The number of inhabitants far exceeds 30,000. Here are four churches or chapels. That of St Nicholas is the mother church, a curious fabric, built cathedral-wise by David king of Scots, 240 feet long, 75 broad, and proportionably high, with a tower steeple 194 feet in height, of Gothic architecture; also St Andrew's, St John's, and All Saints, lately rebuilt on the site of the old structure, of a circular form. Here are also several meeting houses, and four charity schools for 300 children; a fine hall for the surgeons, and a large prison called *Newgate;* also an hospital for lunatics, another for the lying-in of married women, as well as a fund raised for the relief of those who are delivered at their own houses. Here is a well endowed and large infirmary, and an assembly room that attracts attention, containing every useful apartment, and a ball-room 93 feet by 40: The front is ornamented with six Ionic pillars, &c. In another part of the town is a new theatre. Here is a very neat set of baths. A free grammar school was granted by James I. from an old foundation of St Mary's hospital, in the vestry room of whose chapel is the election of the officers of the corporation. There were formerly several palaces in this city, viz. Pampedon hall, Lumley place, Earl's place, Northumberland house, Westmoreland place, &c. The free masons have lately erected an elegant hall, richly ornamented, to hold their lodge in, near High friar chair, capable of holding above 4000 of that ancient fraternity. Here is an hospital for 39 decayed freemen and their widows; and another for three clergymen's widows and three merchants widows. The Maiden's hospital, built in 1753, is endowed with 2400l. for six maiden women and six poor men. Dr Thomlin, a prebendary of St Paul's, and rector of Whicham in the bishopric of Durham, lately gave a library of above 6000 valuable books to the corporation, and settled a rent charge of 5l. a-year for ever for buying new ones; and Walter Blacket, Esq; one of its representatives in parliament, built a neat repository for them, and settled 25l. a-year for ever on a librarian. The upper or north part of the town, inhabited by the politer sort of people, is much pleasanter than that part next the river, and has three level, well built, and spacious streets. The river all the way up from Shields to Newcastle is broad, the channel safe, and the tide flows with a strong current to the town, and far beyond it. In the beginning of the late civil wars, this town was taken and plundered by the *Scotch fanatics*, who here sold their king, Charles I. for 200,000l. in hand, and security for as much more. The glass works are very curious, and have more business of the fine sort than most other places. Besides, it has a considerable manufacture of broad and narrow cloths, and several soap boileries; and this place is famous for grindstones, for which there is such a demand, that scarce a ship stirs without them; from whence came the proverb, "That a Scotsman and a Newcastle grindstone travel all the world over." Ships fit for the coal trade are built here to perfection, with great strength. Here is a considerable manufactory of hardware and wrought iron, after the manner of that at Sheffield.—Its markets are on Tuesdays and Saturdays. Its fairs in August, which last nine days, and October 29th, which

Newcaſtle. which laſt nine days. By an act of Queen Mary, the price of the carriage of goods hither from London by waggons was ſettled at 2d. per lb. London alone is ſaid to conſume at leaſt 766,887 chaldrons of its coal every year: but as for the fiſh vended in that city by the name of *Newcaſtle ſalmon*, it is more properly called *Berwick ſalmon*, the freſh ſalmon being taken near 50 miles farther, as far as the Tweed, and brought on the backs of horſes to Shields, where it is cured, pickled, and ſent on board for London. It is worth remembering, that at the aſſizes here in 1743, two old men were ſubpœna'd hither as witneſſes from a neighbouring village, viz. one 135 years of age, and his ſon 95, both hearty, and having their ſight and hearing; and that in 1744, one Adam Turnbull died in this town aged 112, who had had four wives, the laſt of whom he had married when he was near 100 years old.

The annual amount of the revenue of cuſtoms at this port, which Mr Brand in his Hiſtory of Newcaſtle ſtates at 41,000l. is now very conſiderably upwards of 70,000l.

The coals carried out of it annually (on an average from 1785 to 1791) were nearly 448,000 Newcaſtle chaldrons; the weight of which is 1,187,200 tons.

The manufacture of earthen ware is greatly increaſed, and carried on to great perfection in its neighbourhood, in ſeven potteries; and their produce exported hence to foreign parts, as well as to the different ports of this kingdom; ſome of which potteries conſtantly employ upwards of 100 perſons, men, women, and children.

New works of conſiderable extent for the manufacture of iron have been eſtabliſhed; as alſo a very capital manufactory for white lead, milled lead, &c.

The trade with the Weſt India iſlands is increaſing, and may in time become very conſiderable; as the port has great advantages, in being able to ſupply on the cheapeſt terms many articles wanted in thoſe iſlands; ſuch as coals, grindſtones, lime, bricks, tiles, iron wares, &c.; and is moſt advantageouſly ſituated for the re-exportation of the Weſt India produce to the ports on the Baltic, to Germany, the United Provinces, Flanders, and part of France; and moreover, the riſk of navigation, and the rate of inſurance, not being greater than between thoſe iſlands and Liverpool, and ſome other ports on the weſtern coaſt of this kingdom.

The town of Newcaſtle is daily increaſing in its population and opulence; and it would be well if it could not be added, in luxury, the almoſt neceſſary conſequence of riches: but it ſhould not be omitted, that it is noted for hoſpitality and good living.

Great improvements have been made in the town, by opening new ſtreets, and paving the principal ones, in the ſame manner as in London. It cannot be ſaid that it is well lighted, the few lamps ſcattered here and there ſerving but to make darkneſs viſible; nor have the orders repeatedly given by the magiſtrates for cleaning the ſtreets been attended with the full deſired effect.

To the liſt of public edifices of modern erection, and mentioned above, viz. the grand aſſembly rooms, and the elegant theatre, which were built by ſubſcription, and the ſuperb pariſh church of All Saints, built at a very great expence by the pariſhioners, may be added a commodious riding houſe, built alſo by ſubſcription. Newcaſtle || New Foreſt.

NEWCASTLE, a borough town of Ireland, in the county of Dublin, and province of Leinſter, which returns two members to parliament, and holds two fairs, 9th of May and 8th of October.

NEWCASTLE is alſo the name of a handſome town in the county of Limerick and province of Munſter, on the high road to Kerry, 114 miles from Dublin. Here was a religious houſe poſſeſſed by the knights templars. It is ſaid, they uſed ſome barbarous cuſtoms which greatly diſguſted the Iriſh, who, watching a favourable opportunity, attacked a number of the knights riding out together and put them to death; the place is ſtill remembered where their remains were interred. This order was ſuppreſſed in the famous council of Vienna, 22d of March 1312. Newcaſtle conſiſts of a large ſquare where markets and fairs are held; on the northern ſide ſtands a market houſe, with an aſſembly room; on the ſouth ſide is the church, which is the neateſt in the county, and it was finiſhed in 1777 at the ſole expence of Lord Courtenay. It ſtands cloſe to the walls and fortifications of the knights templars, of which one of the caſtles is fitted up for Lord Courtenay's agent.

NEWCASTLE, a ſmall town in America, 35 miles below Philadelphia, on the weſt bank of Delaware river. It was firſt ſettled by the Swedes about the year 1627, and called *Stockholm*. It was afterwards taken by the Dutch, and called *New Amſterdam*. When it fell into the hands of the Engliſh, it was called by its preſent name. It contains about 60 houſes, which have the aſpect of decay, and was formerly the ſeat of government. This is the firſt town that was ſettled on Delaware river.

NEWCASTLE (Duke of). See CAVENDISH.

*New England*. See ENGLAND (*New*.)

*New Foreſt* of Hampſhire in England, is a tract of at leaſt 40 miles in compaſs, which had many populous towns and villages, and 36 mother churches, till it was deſtroyed and turned into a foreſt by William the Conqueror. There are nine walks in it; and to every one a keeper, under a lord warden, beſides two rangers, and a bow-bearer. As this large tract lay many ages open and expoſed to invaſions from foreigners, King Henry VIII. built ſome caſtles in it; and it has now ſeveral pretty towns and villages. It is ſituated in that part of Hampſhire which is bounded on the eaſt by Southampton river, and on the ſouth by the Britiſh Channel. It poſſeſſes advantages of ſituation, with reſpect to the convenience of water carriage and nearneſs to the dock yards, ſuperior to every other foreſt, having in its neighbourhood ſeveral ports and places of ſhelter for ſhipping timber, among which Lymington is at the diſtance of only two miles, Bewley about half a mile, and Redbridge three or four miles from the foreſt; and the navigation to Portſmouth, the moſt conſiderable dock yard in this kingdom, is only about 30 miles from the neareſt of thoſe places. This is the only foreſt belonging to the crown of which the origin is known. Doomſday-book contains the moſt diſtinct account of its afforeſtation by William the Conqueror: the contents of

every field, farm, or estate afforested, in hides, carucates, or virgates, by which the extent of land was then computed, together with the names of the hundreds and villages, and of the former proprietors (which are for the most part Saxon), the rent or yearly value of each possession, and the tax which had been paid for it to the crown during the reign of Edward the Confessor, before the inhabitants were expelled, and that part of the country laid waste, are all to be found in that most curious and venerable record. Wishing to discover the original extent of the forest, we extracted, for our own information, all that relates to it in that ancient survey. The extract is far too voluminous for insertion. The names of many of the places having been changed since that time, it is difficult to ascertain with precision what were then the limits of the forest. The oldest perambulation we have met with is among the Pleas of the Forest, in the eighth year of King Edward I. preserved in the Chapter-house at Westminster. The boundaries there described include all the country from Southampton river on the east to the Avon on the west, following the sea coast as far as the southern boundary between those rivers, and extending northwards as far as North Chadeford, or North Charford, on the west, and to Wade and Orebrugg, or Owerbridge, on the east; and the greatest part, if not the whole, of that extensive district, is mentioned in Doomsday book to be the forest belonging to the crown. Another perambulation was however made in the 29th of the same king, which leaves out a great part of the country contained within the former. This perambulation, which is preserved in the tower of London, confines the forest to limits which, as far as we can trace them, appear to have been followed in the 22d year of Charles II. when the forest was again perambulated. By the *Charta de Foresta*, all lands not belonging to the crown which had been afforested by Henry II. Richard I. or King John, were to be disafforested; but as no provision was made for the reduction of the more ancient afforestations, it is easy to account for the great diminution of this forest in the reign of Edward I. who was not a prince likely to submit to any encroachment on his rights. The perambulation of the 22d of Charles II. is the last which we find on record: it contains the present legal bounds of the forest, and was given to the surveyors as their guide, in taking the plan which they have made lately by direction. From that plan, with the approbation of the lords commissioners of his majesty's treasury, an engraving was made. According to the last-mentioned perambulation and the plan, the forest extends from Godshill on the north-west to the sea on the south-east, about 20 miles; and from Hardley on the east to Ringwood on the west, about 15 miles; and contains within those limits about 92,365 acres statute measure. The whole of that quantity, however, is not forest land, or now the property of the crown: there are several manors and other considerable freehold estates within the perambulation, belonging to individuals, to the amount of about 24,797 acres; about 625 acres are copyhold or customary lands belonging to his majesty's manor of Lyndhurst; about 1004 acres are lease-hold under the crown, granted for certain terms of years, and forming part of the demised land revenue, under the management of the surveyor-general of crown lands; about 901 acres are purprestures or encroachments on the forest; about 1193 acres more are enclosed lands held by the master-keepers and groom-keepers, with their respective lodges; and the remainder, being about 63,845 acres, are woods and waste lands of the forest. To perpetuate the spot where William Rufus was killed by the glance of an arrow shot at a stag, a triangular stone was erected in 1745. George III. visited this spot in 1789. In August 1782, a curious ancient golden cross was found here by a labouring man digging turf. It weighed above an ounce of gold, and had on one side an engraving of our Saviour, and on the other, the ladder, spear, nails, and other emblems of his sufferings.



*New Holland.* See *Holland (New)*.

*New York.* See *York (New)*.

*New Zealand.* See *Zealand (New)*.

*New Years Gifts.* Presents made on the first day of the new year. Nonius Marcellus refers the origin of this custom among the Romans to Tatius king of the Sabines, who reigned at Rome conjointly with Romulus, and who having considered as a good omen a present of some branches cut in a wood consecrated to *Strenia*, the goddess of strength, which he received on the first day of the new year, authorized this custom afterwards, and gave to these presents the name of *strenæ*. However this may be, the Romans on that day celebrated a festival in honour of Janus, and paid their respects at the same time to Juno; but they did not pass it in idleness, lest they should become indolent during the rest of the year. They sent presents to one another of figs, dates, honey, &c. to show their friends that they wished for a happy and agreeable life. Clients, that is to say, those who were under the protection of the great, carried presents of this kind to their patrons, adding to them a small piece of silver. Under Augustus, the senate, the knights, and the people, presented such gifts to him, and in his absence deposited them in the capitol. Of the succeeding princes some adopted this custom and others abolished it; but it always continued among the people. The early Christians condemned it, because it appeared to be a relick of Paganism and a species of superstition; but when it began to have no other object than that of being a mark of veneration and esteem, the church ceased to disapprove of it.

NEWEL, in architecture, is the upright post which a pair of winding stairs turn about; this is properly a cylinder of stone, which bears on the ground, and is formed by the end of the steps of the winding stairs.

NEWFIDLER-sea, a lake in Hungary, 17 miles in length and 6 in breadth.

NEWFOUNDLAND, a large island of North America, belonging to Great Britain, lying between 46. 50. and 51. 30. N. Lat. and between 53. 30. and 58. 20. W. Long. from London. The form is that of an irregular triangle, the base or south side being 80 leagues in extent; the east side is the longest; and the whole circumference about 150 leagues. It is bounded on the north by the straits of Belleisle, which separate it from Labrador; on the east and

Newfoundland. south it hath the Atlantic ocean, and on the west the gulf of St Lawrence. The climate is rather severe; and the soil, at least on the sea coast, which is all that we know of it, is poor and barren. A few kitchen vegetables with strawberries and raspberries are all its produce. The country within land is mountainous, and abounds with timber; there are several rivers which are plentifully stored with various sorts of fish, abundance of deep bays, and many good ports. St John's and Placentia are the two principal settlements, and at each of these there is a fort; the number of people who remain here in the winter hath been computed at 4000. The French, by the treaty of Utrecht, were permitted to fish from Cape Bonavista on the east side round the north of the island to Point Rich on the west; and by the treaty of Paris, they are allowed the isles of St Pierre and Miquelon, upon which they are to dry their fish, but not to erect fortifications of any kind.

The great importance of this place arises from its fishery, which is in part carried on by the inhabitants at the several harbours, which are about 20 in number, who take vast quantities of cod near the coast, which they bring in and cure at their leisure, in order to have it ready for the ships when they arrive. But the great and extensive fishery is on the banks at some distance from the island. The great bank lies 20 leagues from the nearest point of land from the latitude 41° to 49°, stretching 300 miles in length and 75 in breadth.— To the east of this lies the False Bank; the next is styled *Vert* or *the Green Bank*, about 240 miles long, and 120 over; then Banquero, about the same size; the shoals of Sand Island, Whale Bank, and the Bank of St Peter's, with several others of less note, all abounding with fish.

The cod are caught only by a hook; and an expert fisher will take from 150 to 300 and upwards in a day; for the fish never bite in the night, and the labour is very great. The season is from May to October, in the height of which there are from 500 to 700 sail upon the banks at a time. The fish caught in the spring months are best; they are cured in very different ways. Some are styled *white fish*, others *mud fish*, which are stowed and salted in the hold, and will not keep long; but the best and most valuable are the dried cod. The quantity taken is prodigious: yet in some seasons and in different places varies considerably, as the fish frequently change their stations. The *fishing ships*, as they are called, lie upon the banks, with the help of their boats take and cure their own fish, and as soon as they are full sail for a market. The sack ships proceed directly to the island, where they purchase fish from the inhabitants either by barter or bills of exchange. The principal markets for cod are Spain, Portugal, Italy, and the West Indies. The value of this fishery is computed at some hundred thousand pounds annually; employing, besides several hundred ships, some thousands of seamen, and affording a maintenance to a number of tradesmen of different occupations, by which many large towns on the west side of England accumulate much wealth, and at the same time contribute in many respects to the benefit of the public.

The great utility of this fishery was very early seen, and very vigorously pursued; for in the beginning of the reign of King James I. we had two hundred and fifty sail employed therein. It is computed, that three quintals of wet fish make one quintal of dried cod. Besides, the livers of every hundred quintals make a hogshead of oil; and exclusive of these there are many lesser advantages that go in diminution of the expence. The fishery, as we have said above, produces differently in different seasons; but it is judged to be a very good one when it produces 300,000 quintals of fish and 3000 barrels of oil, both equally saleable and valuable commodities. As every ship carries twelve, and each of their boats eight men, and as these return home in six months there cannot be a more noble nursery for seamen. The artificers and traders employed in building, victualling, and repairing these vessels, are very numerous in the respective ports from which they sail. These circumstances justify the particular attention paid by government to this branch of the public service; in respect to which that they may be well informed, an annual and very distinct account, by which the whole is seen at one view, is delivered by the proper officer to the governor of Newfoundland, that is, to the commodore of his majesty's squadron. Mr Pennant, in the appendix to his Arctic Zoology, gives us, from what appears to be very good authority, the following account of this island. Newfoundland.

"Within the circuit of 60 miles of the southern part, the country is hilly, but not mountainous. The hills increase in height as they recede from the sea; their course is irregular, not forming a chain of hills, but rising and falling abruptly. The coasts are high, and the shores most remarkably bold. The same may be said of almost every part of this vast island. The country is much wooded, and the hills (such as have not flat tops to admit the rain to stagnate on them) are clothed with birch, with hazel, spruce, fir, and pine, all small; which is chiefly owing to the inhabitants taking off the bark to cover the fish stages. This peninsula is so indented by the fine and deep bays of Placentia, St Mary, Conception, and Trinity, that it may be easily penetrated in all parts, which is done for the sake of fowling, or the procuring of spars for masts, oars, &c. The island is on all sides more or less pierced with deep bays, which peninsulate it in many places by isthmuses most remarkably narrow.— The mountains on the south-west side, near the sea, are very high, and terminate in lofty headlands; such are Chapeau Rouge, a most remarkably high promontory, Cape St Mary's, and Cape le Hune. Such in general is the formation of the island; on the north-east, most of the hills in the interior part of the country terminate pyramidally, but form no chain. The interior parts of the country consist chiefly of morasses, or dry barren hammocks, or level land, with frequent lakes or ponds, and in some places covered with stunted black spruce. The rivers of Newfoundland are unfit for navigation, but they are of use in floating down the wood with the summer floods. Still the rivers and the brooks are excellent guides for the hunters of beavers and other animals, to penetrate up the country, which as yet has never been done deeper than 30 miles. Near the brooks it is that timber is commonly met with, but seldom above three or four miles inland, and in valleys; the hills in the northern district being naked and barren.

"In some parts of Newfoundland there is timber sufficiently

Newfoundland. ficiently large for the building of merchant ships: the hulk is made of juniper, and the pine furnishes masts and yards; but as yet none has been found large enough for a mast for a large cutter. The fishery is divided into two seasons; that on the shore, or the shore season, commences about the 20th of April, and ends about the 10th of October; the boats fish in from four to 20 fathoms of water. The most important, the bank fishing season, begins the 10th of May, and continues till the last of September, and is carried on in 30 to 45 fathoms depth of water. Banking vessels have sailed from St John's to the bank as early as the 12th of April. At first they use pork or birds for a bait; but as they catch fish, they supply themselves with a shell fish called clams, which is found in the belly of the cod. The next bait is the lobster; after that the herring and the launce, which last till June, when the capelan comes on the coast, and is another bait. In August the squid comes into use, and finally the herring again. The greatest number of cod fish taken by a single fisherman in the season has been 12,000, but the average is 7000. The largest fish which has been taken was four feet three inches long, and weighed 46 pounds. A banking vessel of 10,000 fish ought to be filled in three weeks, and so in proportion; and 80 quintals (112 lb. each) for a boat in the same time.

"In 1785, 541 English vessels fished on the bank, a number exceeding that of the French. A heap of dried fish, 20 feet long and ten wide, and four deep, contains 300 quintals. Such a heap settles, in the course of 48 hours after it is made, about $\frac{1}{11}$. An extraordinary splitter will split five quintals of fish in an hour. The average in that time is two. There is no fishing during winter, on account of the inclemency of the season. It is supposed that the fish in a great measure quit the banks before that time, as in general they are very scarce when the fishing vessels go upon the banks early in the spring.

"There are a few small towns on the coasts, which have gardens sown with English pulse; but many of the inhabitants quit the country in winter.

"An admiral or some sea officer is governor of Newfoundland. He sails from England in May, and returns by the 30th of November."

NEWMARKET, in Cambridgeshire, 13 miles from Cambridge, 13 from St Edmundsbury, and 60 from London, is a town with one long street, the north side in Suffolk, the south side in Cambridgeshire. It is a healthy place, and a great thoroughfare in the road from London to Norfolk; but stands mostly by the horse races every year in April and October, here being the finest course in England; on which there is a house for the king when he comes to the races, which was built by Charles II. The king gives a plate or two every year, besides those given by the nobility; and wagers are laid upon the horses, which are seldom under 500l. and often above 1000l. Here are two coffeehouses, at which, every night and morning during the races, there is gaming, as there is also at the houses of the nobility and gentry. Here are also cock matches. Here is a little chapel, which is a chapel of ease to the mother church at Ditton; and another in the Suffolk side, which is parochial. The town was burnt in 1683, but soon rebuilt. Here are two charity schools, one for 20 boy another for 20 girls, supported by 50l. a-year, first settled by Queen Anne. Here is a market on Tuesdays and Thursdays, and fairs on October 28. and Whitsun-Tuesday.

Newross ‖ New Style.

NEWROSS, a borough town in the county of Wexford, and province of Leinster, in Ireland, 67 miles from Dublin. It returns two members to parliament; the patronage is in the families of Tottenham and Leigh. This town was formerly walled, and some of the gates still remain. It lies on the river Barrow, which is here very deep, and ships of burden can come up to the quay even when the tide is out. The church is large, but the customhouse and quay are both small, and sometimes overflooded many feet. It is one of the staple ports for exporting wool, yet its trade is but inconsiderable; beef and butter are the principal articles exported. Here is a barrack for a troop of horse, and a good ferry into the county of Kilkenny. Near this town is a charter school. It is also a post town, and gives title of earl to the family of Gore. It was formerly fortified, and adorned with many religious houses, among which was a crouched friary, built on the summit of a hill in the town; but one of the friars having killed a principal inhabitant, the whole body of the people arose, put the friars to death, and totally destroyed the friary; on the site of which the monastery of St Saviour, for conventual Franciscans, was afterwards erected by Sir John Devereux; and the east end of this last building is now the parish church. A friary for Eremites, following the rule of St Augustine, was also founded here in the reign of Edward III.

NEWSPAPERS, periodical publications, daily, weekly, &c. for the purpose of communicating to the world every thing of importance, whether political or literary, &c. which is going on. They have tended much to the dissemination of learning, and have served many other valuable purposes; and while they are carried on with candour, impartiality, and ability, they are unquestionably a great national benefit. W[illegible] this, however, is not the case, and it often happens, they disgrace their authors, and are highly injurious to the public. They were first published in England, August 22. 1642. *Journal des Sçavans*, a French paper, was first published in 1665, though one was printed in England, under the title of the *Public Intelligencer*, by Sir Roger L'Estrange, 1663, which he dropped, on the publication of the first London Gazette. Newspapers and pamphlets were prohibited by royal proclamation 1680. Though at the Revolution prohibitions of this kind were done away, and the press set at liberty, yet newspapers were afterwards made objects of taxation, and for this purpose were first stamped 1713. The number of them, however, gradually increased; and there were printed in the whole kingdom during the years 1775, 12,680,000; 1776, 12,830,000; 1777, 13,150,642; 1778, 13,240,059; 1779, 14,106,842 1780, 14,217,371; 1781, 14,397,620; 1782, 15,272,519. They are now still more numerous.

NEW STYLE, first used in England in 1753, was introduced into the western world by Pope Gregory XIII. See CHRONOLOGY, N° 24.

Newt, Newton. NEWT, or Eft, in zoology, the common lizard. See Lacerta.

NEWTON (Sir Isaac), one of the greatest philosophers and mathematicians the world has ever produced, was the only child of Mr John Newton of Colesworth, not far from Grantham in Lincolnshire, who had an estate of about 120l. *per annum*, which he kept in his own hands. He was born at that place on Christmas day 1642. His father dying when he was young, his mother's brother, a clergyman of the name of *Ayscough*, or *Askew*, who lived near her, and directed all her affairs after the death of Mr Newton, put her son to school at Grantham. When he had finished his school learning, his mother took him home, intending, as she had no other child, to have the pleasure of his company; and that he, as his father had done, should occupy his own estate. But his uncle happening to find him in a hay loft at Grantham working a mathematical problem, and having otherwise observed the boy's mind to be uncommonly bent upon learning, he prevailed upon her to part with him; and she sent him to Trinity College in Cambridge, where her brother, having himself been a member of it, had still many friends. Isaac was soon taken notice of by Dr Isaac Barrow; who, observing his bright genius, contracted a great friendship for him. M. de Fontenelle tells us, "That in learning mathematics he did not study Euclid, who seemed to him too plain and simple, and unworthy of taking up his time. He understood him almost before he read him; and a cast of his eye upon the contents of his theorems was sufficient to make him master of them. He advanced at once to the geometry of Des Cartes, Kepler's Optics, &c. It is certain that he had made his great discoveries in geometry, and laid the foundation of his two famous works the *Principia* and the *Optics*, by the time he was 24 years of age."

In 1664, he took the degree of bachelor of arts; and in 1668 that of master, being elected the year before, fellow of his college. He had before this time discovered the method of fluxions; and in 1669 he was chosen professor of mathematics in the university of Cambridge, upon the resignation of Dr Barrow. The same year, and the two following, he read a course of optical lectures in Latin, in the public schools of the university; an English translation of which was printed at London in 1728, in 8vo, as was the Latin original the next year in 4to. From the year 1671 to 1679, he held a correspondence by letters with Mr Henry Oldenburg secretary of the Royal Society, and Mr John Collins fellow of that society; which letters contain a variety of curious observations.

Concerning the origin of his discoveries, we are told, that as he sat alone in a garden, the falling of some apples from a tree led him into a speculation on the power of gravity; that as this power is not diminished at the remotest distance from the centre of the earth to which we can rise, it appeared to him reasonable to conclude, that it must extend much farther than was usually thought; and pursuing this speculation, by comparing the periods of the several planets with their distances from the sun, he found, that if any power like gravity held them in their courses, its strength must decrease in the duplicate proportion of the increase of distance. This inquiry was dropped; but resumed again, and gave rise to his writing the treatise which he published in 1687, under the name of *Mathematical Principles of Natural Philosophy*; a work looked upon as the production of a celestial intelligence rather than of a man. The very same year in which this great work was published, the university of Cambridge was attacked by King James II. when Mr Newton was one of its most zealous defenders, and was accordingly nominated one of the delegates of that university to the high-commission court; and the next year he was chosen one of their members for the convention parliament, in which he sat till it was dissolved. In 1696, Mr Montague, then chancellor of the exchequer, and afterwards earl of Halifax, obtained for him of the king the office of warden of the mint; in which employment he was of signal service, when the money was called in to be recoined. Three years after, he was appointed master of the mint; a place of very considerable profit, which he held till his death. In 1699, he was elected one of the members of the Royal Academy of Sciences at Paris. In 1701, he was a second time chosen member of parliament for the university of Cambridge. In 1704, he published his *Optics*; which is a piece of philosophy so new, that the science may be considered as entirely indebted to our author. In 1705, he was knighted by Queen Anne. In 1707, he published his *Arithmetica Universalis*. In 1711, his *Analysis per Quantitatum Series, Fluxiones et Differentias*, &c. was published by William Jones, Esq. In 1712, several letters of his were published in the *Commercium Epistolicum*. In the reign of George I. he was better known at court than before. The princess of Wales, afterwards queen consort of England, used frequently to propose questions to him, and to declare that she thought herself happy to live at the same time with him, and have the pleasure and advantages of his conversation. He had written a treatise of ancient chronology, which he did not think of publishing; but the princess desired an abstract, which she would never part with. However, a copy of it stole abroad, and was carried into France; where it was translated and printed, with some observations, which were afterwards answered by Sir Isaac. But, in 1728, the Chronology itself was published at London in quarto; and was attacked by several persons, and as zealously defended by Sir Isaac's friends. The main design of it was to find out, from some tracts of the most ancient Greek astronomy, what was the position of the colures with respect to the fixed stars, in the time of Chiron the centaur. As it is now known that these stars have a motion in longitude of one degree in 72 years, if it is once known through what fixed stars the colure passed in Chiron's time, by taking the distance of these stars from those through which it now passes, we might determine what number of years is elapsed since Chiron's time. As Chiron was one of the Argonauts, this would fix the time of that famous expedition, and consequently that of the Trojan war; the two great events upon which all the ancient chronology depends. Sir Isaac places them 500 years nearer the birth of Christ than other chronologers generally do.

This great man had all along enjoyed a settled and equal state of health to the age of 80, when he began to be afflicted with an incontinence of urine,

urine. However, for the five following years, he had great intervals of ease, which he procured by the observance of a strict regimen. It was then believed that he certainly had the stone; and when the paroxysms were so violent, that large drops of sweat ran down his face, he never uttered the least complaint, or expressed the smallest degree of impatience; but, as soon as he had a moment's ease, would smile and talk with his usual cheerfulness. Till then he always read and wrote several hours in a day. He had the perfect use of all his senses and understanding till the day before he died, which was on the 20th of March 1726-7 in the 85th year of his age. He lay in state in the Jerusalem chamber at Westminister, and on the 28th of March his body was conveyed into Westminster abbey; the pall being supported by the lord chancellor, the dukes of Montrose and Roxburgh, and the earls of Pembroke, Sussex, and Macclesfield. The bishop of Rochester read the funeral office, being attended by all the clergy of the church. The corpse was interred just at the entrance into the choir, where a noble monument is erected to his memory.

Sir Isaac was of a middling stature, and in the latter part of his life somewhat inclined to be fat. His countenance was pleasing and at the same time venerable. He never made use of spectacles, and lost but one tooth during his whole life.

His temper is said to have been so equal and mild, that no accident could disturb it. Of this the following remarkable instance is related. Sir Isaac had a favourite little dog, which he called *Diamond;* and being one day called out of his study into the next room, Diamond was left behind. When Sir Isaac returned, having been absent but a few minutes, he had the mortification to find, that Diamond having thrown down a lighted candle among some papers, the nearly finished labour of many years, was in flames, and almost consumed to ashes. This loss, as Sir Isaac was then very far advanced in years, was irretrievable; yet without once striking the dog, he only rebuked him with this exclamation, "Oh! Diamond! Diamond! thou little knowest the mischief thou hast done!

He was a great lover of peace, and would rather have chosen to remain in obscurity than to have the calm of life ruffled by those storms and disputes which genius and learning always draw upon those that are peculiarly eminent for them. In contemplating his genius it presently becomes a doubt, which of these endowments had the greatest share, sagacity, penetration, strength or diligence: and after all, the mark that seems most to distinguish it is, that he himself made the justest estimation of it, declaring, that, if he had done the world any service, it was due to nothing but industry and patient thought; that he kept the subject under consideration constantly before him, and waited till the first dawning opened gradually, by little and little, into a full and clear light. It is said, that when he had any mathematical problems or solutions in his mind, he would never quit the subject on any account. Dinner has been often three hours ready for him before he could be brought to table: and his man often said, when he has been getting up in a morning, he has sometimes begun to dress, and with one leg in his breeches sat down again on the bed, where he has remained for hours before he got his clothes on. From his love of peace, no doubt, arose that unusual kind of horror which he had for all disputes; a steady unbroken attention, free from those frequent recoilings inseparably incident to others, was his peculiar felicity; he knew it, and he knew the value of it. No wonder then that controversy was looked on as his bane. When some objections, hastily made to his discoveries concerning light and colours, induced him to lay aside the design he had of publishing his optic lectures, we find him reflecting on that dispute, into which he was unavoidably drawn thereby, in these terms: "I blamed my own imprudence for parting with so real a blessing as my quiet, to run after a shadow." It is true this shadow (as Mr Fontenelle observes) did not escape him afterwards, nor did it cost him that quiet which he so much valued, but proved as much a real happiness to him as his quiet itself; yet this was a happiness of his own making: he took a resolution, from these disputes, not to publish any more about that theory till he had put it above the reach of controversy, by the exactest experiments and the strictest demonstrations; and accordingly it has never been called in question since. In the same temper, after he had sent the manuscript of his *Principia* to the Royal Society, with his consent to the printing of it by them, upon Mr Hook's injuriously insisting that himself had demonstrated Kepler's problem before our author, he determined, rather than be involved again in a controversy, to suppress the third book, and was very hardly prevailed upon to alter that resolution. It is true, the public was thereby a gainer; that book, which is indeed no more than a corollary of some propositions in the first, being originally drawn up in the popular way, with the design to publish it in that form; whereas he was now convinced that it would be best not to let it go abroad without a strict demonstration.

After all, notwithstanding his anxious care to avoid every occasion of breaking his intense application to study, he was at a great distance from being steeped in philosophy: on the contrary, he could lay aside his thoughts, though engaged in the most intricate researches, when his other affairs required his attendance; and as soon as he had leisure, resume the subject at the point where he had left off. This he seems to have done not so much by any extraordinary strength of memory, as by the force of his inventive faculty to which every thing opened itself again with ease, if nothing intervened to ruffle him. The readiness of his invention made him not think of putting his memory much to the trial: but this was the offspring of a vigorous intenseness of thought, out of which he was but a common man. He spent, therefore, the prime of his age in those abstruse researches, when his situation in a college gave him leisure, and even while study was his proper profession. But as soon as he was removed to the mint, he applied himself chiefly to the business of that office; and so far quitted mathematics and philosophy, as not to engage in any pursuits of either kind afterwards.

The amiable quality of modesty is represented as standing foremost in the character of this great man's mind and manners. It was in reality greater than can be easily imagined, or will be readily believed; yet it always continued so without any alteration, though the whole world, says Fontenelle, conspired against it; and

Newton. and let us add, though he was thereby robbed of his inventions of fluxions. Nicholas Mercator publishing his *Logarithmotechnia* in 1668, where he gave the quadrature of the hyperbola by an infinite series, which was the first appearance in the learned world of a series of this sort drawn from the particular nature of the curve, and that in a manner very new and abstracted; Dr Barrow, then at Cambridge, where Mr Newton, at that time about 26 years of age, resided, recollected that he had met with the same thing in the writings of that young gentleman; and there not confined to the hyperbola only, but extended, by general forms, to all sorts of curves, even such as are mechanical; to their quadratures, their rectifications, and their centres of gravity; to the solids formed by their relations, and to the superficies of those solids; so that, when their determinations were possible, the series stopped at a certain point, or at least their sums were given by stated rules; and, if the absolute determinations were impossible, they could yet be infinitely approximated; which is the happiest and most refined method, says Mr Fontenelle, of supplying the defects of human knowledge that man's imagination could possibly invent. To be master of so fruitful and general a theory was a mine of gold to a geometrician; but it was a greater glory to have been the discoverer of so surprising and ingenious a system. So that Mr Newton finding by Mercator's book, that he was in the way to it, and that others might follow in his track, should naturally have been forward to open his treasures, and secure the property, which consisted in making the discovery; but he contented himself with his treasure which he had found, without regarding the glory. What an idea does it give us of his unparalleled modesty, when we see him declaring, that he thought Mercator had entirely discovered his secret, or that others would, before he was of a proper age for writing? His MS. upon infinite series was communicated to none but Mr John Collins and the lord Brounker; and even that had not been complied with, but for Dr Barrow, who would not suffer him to indulge his modesty so much as he desired.

It is further observed, concerning this part of his character, that he never talked either of himself or others, nor ever behaved in such a manner as to give the most malicious censurers the least occasion even to suspect him of vanity. He was candid and affable, and always put himself upon a level with his company. He never thought either his merit or his reputation sufficient to excuse him from any of the common offices of social life; no singularities, either natural or affected, distinguished him from other men. Though he was firmly attached to the church of England, he was averse to the persecution of the non-conformists. He judged of men by their manners; and the true schismatics, in his opinion, were the vicious and the wicked. Not that he confined his principles to natural religion, for he was thoroughly persuaded of the truth of revelation; and amidst the great variety of books which he had constantly before him, that which he studied with the greatest application was the Bible: and he understood the nature and force of moral certainty as well as he did that of a strict demonstration.

Sir Isaac did not neglect the opportunities of doing good, when the revenues of his patrimony, and a profitable employment, improved by a prudent economy, put it in his power. We have two remarkable instances of his bounty and generosity; one to Mr M'Laurin, professor of mathematics at Edinburgh, to whom he offered 20l. per annum; and the other to his niece Barton, who had an annuity of 100l. per annum settled upon her by him. When decency upon any occasion required expence and show, he was magnificent without grudging it, and with a very good grace; at all other times, that pomp which seems great to low minds only, was utterly retrenched, and the expence reserved for better uses. He never married, and perhaps he never had leisure to think of it. Being immersed in profound studies during the prime of his age, and afterwards engaged in an employment of great importance, and even quite taken up with the company which his merit drew to him, he was not sensible of any vacancy in life, nor of the want of a companion at home. He left 32,000l. at his death; but made no will, which Mr Fontenelle tells us was because he thought a legacy was no gift. As to his works, besides what were published in his lifetime, there were found after his death, among his papers, several discourses upon the subjects of antiquity, history, divinity, chemistry, and mathematics, several of which were published at different times.

Newtonian Philosophy.

NEWTONIAN *Philosophy*, the doctrine of the universe, and particularly of the heavenly bodies, their laws, affections, &c. as delivered by Sir Isaac Newton.

1 Different opinions concerning this philosophy.

The term *Newtonian Philosophy* is applied very differently; whence divers confused notions relating thereto. Some authors under this philosophy include all the corpuscular philosophy, considered as it now stands corrected and reformed by the discoveries and improvements made in several parts thereof by Sir Isaac Newton. In which sense it is that Gravesande calls his elements of physics, *Introductio ad Philosophiam Newtonianam*. And in this sense the Newtonian is the same with the new philosophy; and stands contradistinguished from the Cartesian, the Peripatetic, and the ancient Corpuscular.

Others, by *Newtonian Philosophy*, mean the method or order which Sir Isaac Newton observes in philosophizing; viz. the reasoning and drawing of conclusions directly from phenomena, exclusive of all previous hypotheses; the beginning from simple principles; deducing the first powers and laws of nature from a few select phenomena, and then applying those laws, &c. to account for other things. And in this sense the *Newtonian philosophy* is the same with the *experimental philosophy*, and stands opposed to the ancient *Corpuscular*.

Others, by *Newtonian philosophy*, mean that wherein physical bodies are considered mathematically, and where geometry and mechanics are applied to the solution of the appearances of nature. In which sense the Newtonian is the same with the *mechanical* and *mathematical philosophy*.

Others again, by *Newtonian philosophy*, understand that part of physical knowledge which Sir Isaac Newton has handled, improved, and demonstrated, in his *Principia*.

Others, lastly, by *Newtonian philosophy*, mean the new principles which Sir Isaac Newton has brought into philosophy; the new system founded thereon; and the new solutions of phenomena thence deduced; or

Newtonian Philosophy.

or that which characterizes and distinguishes his philosophy from all others.—Which is the sense wherein we shall chiefly consider it.

As to the history of this philosophy, we have nothing to add to what has been given in the preceding article. It was first made public in the year 1687, by the author, then a fellow of Trinity College, Cambridge; and in the year 1713, republished with considerable improvements.—Several authors have since attempted to make it plainer; by setting aside many of the more sublime mathematical researches, and substituting either more obvious reasonings or experiments in lieu thereof; particularly Whiston in his *Prælect. Phys. Mathemat.* Gravesande in *Element. et Instit.* and Dr Pemberton in his *View*.

The whole of the *Newtonian Philosophy*, as delivered by the author, is contained in his *Principia* or *Mathematical Principles of Natural Philosophy*. He founds his system on the following definitions:

Definitions on which the philosophy is founded.

1. The quantity of matter is the measure of the same, arising from its density and bulk conjunctly.—Thus air of a double density, in a double space, is quadruple in quantity; in a triple space, sextuple in quantity, &c.

2. The quantity of motion is the measure of the same, arising from the velocity and quantity of matter conjunctly. This is evident, because the motion of the whole is the motion of all its parts; and therefore in a body double in quantity, with equal velocity, the motion is double, &c.

*Vis insita* defined and objected to.

3. The *vis insita*, or innate force of matter, is a power of resisting, by which every body, as much as in it lies, endeavours to persevere in its present state, whether it be of rest, or moving uniformly forward in a right line.—This definition is proved to be just, only by the difficulty we find in moving any thing out of its place; and this difficulty is by some reckoned to proceed only from gravity. They contend, that in those cases where we can prevent the force of gravity from acting upon bodies, this power of resistance becomes insensible, and the greatest quantities of matter may be put in motion by the very least force. Thus there have been balances formed so exact, that when loaded with 200 weight in each scale, they would turn by the addition of a single drachm. In this case 400 lb. of matter was put in motion by a single drachm, *i e* by $\frac{1}{102400}$ parts of its own quantity: and even this small weight, they say, is only necessary on account of the inaccuracy of the machine: so that we have no reason to suppose, that, if the friction could be entirely removed, it would take more force to move a tun weight than a grain of sand. This objection, however, is not taken notice of by Sir Isaac: and he bestows on the resisting power above mentioned the name of *vis inertiæ*; a phrase which is perhaps not well chosen, and with which inferior writers have endeavoured to make their readers merry at the expence of Newton. A *force of inactivity*, it has been said, is a *forceless* force; and analogous to a *black white*, a *cold heat*, and a *tempestuous calm*.

But objections of more importance have been made to the whole of this doctrine than those which merely respect the term *vis inertiæ*. "An endeavour to remain at rest (we are told*) is unnecessary, whilst nothing attempts to disturb the rest. It is likewise impossible to be conceived, as it implies a contradiction. A man, by opposing force to force, may endeavour not to be moved; but this opposition is an endeavour to *move*, not with a *design* to move, but by counteracting another force to *prevent* being moved. An endeavour not to move therefore cannot exist in bodies, because it is absurd; and if we appeal to fact, we shall find every body in an actual and constant endeavour to move." It has been likewise observed, and we think justly, that "if bodies could *continue* to move by any innate force, they might also *begin* to move by that force. For the same cause which can move a body with a given velocity at one time, could do it, if present, at any other time; and therefore if the force by which bodies continue in motion were innate and essential to them, they would begin to move of themselves, which is not true." Newton indeed says that this innate force is the cause of motion under certain circumstances only, or when the body is acted upon by a force impressed *ab extra*. But if this impressed force do not continue as well as begin the motion, if it cease the instant that the impression is over, and the body continue to move by its *vis inertiæ*, why is the body ever stopped? "If in the beginning of the motion the body, by its innate force, overcomes a certain resistance of friction and air, in any following times, the force being undiminished, it will overcome the same resistance for ever. These resistances, therefore, could never change the state of a moving body, because they cannot change the quantity of its motive force. But this is contrary to universal experience." For these reasons we are inclined to think that bodies are wholly passive; that they endeavour nothing; and that they continue in motion not by any innate force or *vis insita*, but by that force, whatever it be, which begins the motion, and which, whilst it remains with the moving body, is gradually diminished, and at last overcome by opposite forces, when the body of course ceases to move.

* Young's Examination of the third and fourth Definitions of the first Book of the Principia, &c.

4. An impressed force is an action exerted upon a body, in order to change its state, either of rest or of moving uniformly forward in a right line.——This force consists in the action only; and remains no longer in the body when the action is over. For a body maintains every new state it acquires by its *vis inertiæ* only.

It is here implied, and indeed fully expressed, that motion is not continued by the same power that produced it. Now there are two grounds on which the truth of this doctrine may be supposed to rest.

"*First*, On a direct proof that the impressed force does not remain in the body, either by showing the nature of the force to be transitory and incapable of more than its first action; or that it acts only on the surface, and that the body escapes from it; or that the force is somewhere else, and not remaining in the body. But none of these direct proofs are offered.

"*Secondly*, It may rest on an indirect proof, that there is in the nature of body a sufficient cause for the continuance of every new state acquired; and that therefore any adventitious force to continue motion, though necessary for its production, is superfluous and inadmissible. As this is the very ground on which the supposition stands, it ought to have been indubitably certain that the innate force of the body is

Newtonian Philosophy. is sufficient to perpetuate the motion it has once acquired, before the other agent, by which the motion was communicated, had been dismissed from the office. But the innate force of body has been shown not to be that which continues its motion; and therefore the proof, that the impressed force does not remain in the body, fails. Nor indeed is it in this case desirable to support the proof; because we should then be left without any reason for the continuance of motion †." When we mention an impressed force, we mean such a force as is communicated either at the surface of the body or by being diffused through the mass.

† Young's Examination, &c.

5. A centripetal force is that by which bodies are drawn, impelled, or any way tend towards a point, as to a centre.—The quantity of any centripetal force may be considered as of three kinds, absolute, accelerative, and motive.

6. The absolute quantity of a centrifugal force is the measure of the same, proportional to the efficacy of the cause that propagates it from the centre, through the spaces round about.

7. The accelerative quantity of a centripetal force is the measure of the same, proportional to the velocity which it generates in a given time.

8. The motive quantity of a centripetal force is a measure of the same, proportional to the motion which it generates in a given time.—This is always known by the quantity of a force equal and contrary to it, that is just sufficient to hinder the descent of the body.

### Scholia.

4 Of Time.

I. Absolute, true, and mathematical time, of itself, and from its own nature, flows equably, without regard to any thing external, and, by another name, is called *duration*. Relative, apparent, and common time, is some sensible and external measure of duration, whether accurate or not, which is commonly used instead of true time; such as an hour, a day, a month, a year, &c.

5 Space.

II. Absolute space, in its own nature, without regard to any thing external, remains always similar and immoveable. Relative space is some moveable dimension or measure of the absolute spaces; and which is vulgarly taken for immoveable space. Such is the dimension of a subterraneous, an aerial, or celestial space, determined by its position to bodies, and which is vulgarly taken for immoveable space; as the distance of a subterraneous, an aerial, or celestial space, determined by its position in respect of the earth. Absolute and relative space are the same in figure and magnitude; but they do not remain always numerically the same. For if the earth, for instance, moves, a space of our air which, relatively and in respect of the earth, remains always the same, will at one time be one part of the absolute space into which the earth passes; at another time it will be another part of the same; and so, absolutely understood, it will be perpetually mutable.

6 Place defined.

III. Place is a part of space which a body takes up; and is, according to the space, either absolute or relative. Our author says it is *part* of space; not the situation, nor the external surface of the body. For the places of equal solids are always equal; but their superficies, by reason of their dissimilar figures, are often unequal. Positions properly have no quantity, are they so much the places themselves as the properties of places. The motion of the whole is the same thing with the sum of the motions of the parts; that is, the translation of the whole out of its place is the same thing with the sum of the translations of the parts out of their places: and therefore the place of the whole is the same thing with the sum of the places of the parts; and for that reason it is internal, and in the whole body.

7 Of Motion.

IV. Absolute motion is the translation of a body from one absolute place into another, and relative motion the translation from one relative place into another. Thus, in a ship under sail, the relative place of a body is that part of the ship which the body possesses, or that part of its cavity which the body fills, and which therefore moves together with the ship; and relative rest is the continuance of the body in the same part of the ship, or of its cavity. But real absolute rest is the continuance of the body in the same part of that immoveable space in which the ship itself, its cavity, and all that it contains, is moved. Wherefore, if the earth is really at rest, the body which relatively rests in the ship will really and absolutely move with the same velocity which the ship has on the earth. But if the earth also moves, the true and absolute motion of the body will arise, partly from the true motion of the earth in immoveable space; partly from the relative motion of the ship on the earth: and if the body moves also relatively in the ship, its true motion will arise partly from the true motion of the earth in immoveable space, and partly from the relative motions as well of the ship on the earth as of the body in the ship; and from these relative motions will arise the relative motion of the body on the earth. As if that part of the earth where the ship is, was truly moved towards the east, with a velocity of 10010 parts; while the ship itself with a fresh gale is carried towards the west, with a velocity expressed by 10 of these parts; but a sailor walks in the ship towards the east with one part of the said velocity: then the sailor will be moved truly and absolutely in immoveable space towards the east with a velocity of 1001 parts; and relatively on the earth towards the west, with a velocity of 9 of those parts.

Absolute time, in astronomy, is distinguished from relative, by the equation or correction of the vulgar time. For the natural days are truly unequal, though they are commonly considered as equal, and used for a measure of time: astronomers correct this inequality for their more accurate deducing of the celestial motions. It may be that there is no such thing as an equable motion whereby time may be accurately measured. All motions may be accelerated or retarded; but the true or equable progress of absolute time is liable to no change. The duration or perseverance of the existence of things remains the same, whether the motions are swift or slow, or none at all; and therefore ought to be distinguished from what are only sensible measures thereof, and out of which we collect it by means of the astronomical equation. The necessity of which equation for determining the times of a phenomenon is evinced, as well from the experiments of the pendulum clock as by eclipses of the satellites of Jupiter.

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8 Immutability of time and space.

As the order of the parts of time is immutable, so also is the order of the parts of space. Suppose those parts to be moved out of their places, and they will be moved (if we may be allowed the expression) out of themselves. For times and spaces are, as it were, the places of themselves as of all other things. All things are placed in time as to order of succession; and in space as to order of situation. It is from their essence or nature that they are places; and that the primary places of things should be moveable, is absurd. These are therefore the absolute places; and translations out of those places are the only absolute motions.

But because the parts of space cannot be seen, or distinguished from one another by the senses, therefore in their stead we use sensible measures of them. For, from the positions and distances of things from any body, considered as immoveable, we define all places; and then with respect to such places, we estimate all motions, considering bodies as transferred from some of those places into others. And so, instead of absolute places and motions, we use relative ones; and that without any inconvenience in common affairs: but in philosophical disquisitions we ought to abstract from our senses, and consider things themselves distinct from what are only sensible measures of them. For it may be, that there is no body really at rest, to which the places and motions of others may be referred.

But we may distinguish rest and motion, absolute and relative, one from the other by their properties causes, and effects. It is a property of rest, that bodies really at rest do rest in respect of each other. And therefore, as it is possible, that, in the remote regions of the fixed stars, or perhaps far beyond them, there may be some body absolutely at rest, though it be impossible to know from the position of bodies to one another in our regions, whether any of these do keep the same position to that remote body; it follows, that absolute rest cannot be determined from the position of bodies in our regions.

9 Of the motion of different bodies with respect to one another.

It is a property of motion, that the parts which retain given positions to their wholes do partake of the motion of their wholes. For all parts of revolving bodies endeavour to recede from the axis of motion; and the impetus of bodies moving forwards arises from the joint impetus of all the parts. Therefore if surrounding bodies are moved, those that are relatively at rest within them will partake of their motion. Upon which account the true and absolute motion of a body cannot be determined by the translation of it from those only which seem to rest; for the external bodies ought not only to appear at rest, but to be really at rest. For otherwise all included bodies, beside their translation from near the surrounding ones, partake likewise of their true motions; and though that translation was not made, they would not really be at rest, but only seem to be so. For the surrounding bodies stand in the like relation to the surrounded, as the exterior part of a whole does to the interior, or as the shell does to the kernel; but if the shell moves, the kernel will also move, as being part of the whole, without any removal from near the shell.

A property near akin to the preceding is, that if a place is moved, whatever is placed therein moves along with it; and therefore a body which is moved from a place in motion, partakes also of the motion of its place. Upon which account all motions from places in motion, are no other than parts of entire and absolute motions; and every entire motion is composed of the motion of the body out of its first place, and the motion of this place out of its place; and so on, until we come to some immoveable place, as in the above mentioned example of the sailor. Wherefore entire and absolute motions can be no otherwise determined than by immoveable places. Now, no other places are immoveable but those that from infinity to infinity do all retain the same given positions one to another; and upon this account must ever remain unmoved, and do thereby constitute what we call *immoveable space*.

The causes by which true and relative motions are distinguished one from the other, are the forces impressed upon bodies to generate motion. True motion is neither generated nor altered, but by some force impressed upon the body moved: but relative motion may be generated or altered without any force impressed upon the body. For it is sufficient only to impress some force on other bodies with which the former is compared, that by their giving way, that relation may be changed, in which the relative rest or motion of the other body did consist. Again, True motion suffers always some change from any force impressed upon the moving body; but relative motion does not necessarily undergo any changes by such force. For if the same forces are likewise impressed on those other bodies with which the comparison is made, that the relative position may be preserved; then that condition will be preserved, in which the relative motion consists. And therefore any relative motion may be changed when the true motion remains unaltered, and the relative may be preserved when the true motion suffers some change. Upon which account true motion does by no means consist in such relations.

10 Absolute and relative motion distinguished.

The effects which distinguish absolute from relative motion are, the forces of receding from the axis of circular motion. For there are no such forces in a circular motion purely relative: but, in a true and absolute circular motion, they are greater or less according to the quantity of the motion. If a vessel, hung by a long cord, is so often turned about that the cord is strongly twisted, then filled with water, and let go, it will be whirled about the contrary way; and while the cord is untwisting itself, the surface of the water will at first be plain, as before the vessel began to move; but the vessel, by gradually communicating its motion to the water, will make it begin sensibly to revolve, and recede by little and little from the middle, and ascend to the sides of the vessel, forming itself into a concave figure; and the swifter the motion becomes, the higher will the water rise, till at last, performing its revolutions in the same times with the vessel, it becomes relatively at rest in it. This ascent of the water shows its endeavour to recede from the axis of its motion; and the true and absolute circular motion of the water, which is here directly contrary to the relative, discovers itself, and may be measured by this endeavour. At first, when the relative motion in the water was greatest, it produced no en-

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deavour to recede from the axis; the water showed no tendency to the circumference, nor any ascent towards the sides of the vessel, but remained of a plane surface; and therefore its true circular motion had not yet begun. But afterwards, when the relative motion of the water had decreased, the ascent thereof towards the sides of the vessel proved its endeavour to recede from the axis; and this endeavour showed the real circular motion of the water perpetually increasing, till it had acquired its greatest quantity, when the water rested relatively in the vessel. And therefore this endeavour does not depend upon any translation of the water in respect of the ambient bodies; nor can true circular motion be defined by such translations. There is only one real circular motion of any one revolving body, corresponding to only one power of endeavouring to recede from its axis of motion, as its proper and adequate effect: but relative motions in one and the same body are innumerable, according to the various relations it bears to external bodies; and, like other relations, are altogether destitute of any real effect, otherwise than they may perhaps participate of that only true motion. And therefore, in the system which supposes that our heavens, revolving below the sphere of the fixed stars, carry the planets along with them, the several parts of those heavens and the planets, which are indeed relatively at rest in their heavens, do yet really move. For they change their position one to another, which never happens to bodies truly at rest; and being carried together with the heavens, participate of their motions, and, as parts of revolving wholes, endeavour to recede from the axis of their motion.

Wherefore relative quantities are not the quantities themselves whose names they bear, but those sensible measures of them, either accurate or inaccurate, which are commonly used instead of the measured quantities themselves. And then, if the meaning of words is to be determined by their use, by the names *time*, *space*, *place*, and *motion*, their measures are properly to be understood; and the expression will be unusual and purely mathematical, if the measured quantities themselves are meant.

It is indeed a matter of great difficulty to discover, and effectually to distinguish, the true motions of particular bodies from those that are only apparent: because the parts of that immoveable space in which those motions are performed, do by no means come under the observation of our senses. Yet we have some things to direct us in this intricate affair; and these arise partly from the apparent motions which are the difference of the true motions, partly from the forces which are the causes and effects of the true motions. For instance, if two globes, kept at a given distance one from the other by means of a cord that connects them, were revolved about their common centre of gravity; we might, from the tension of the cord, discover the endeavour of the globes to recede from the axis of motion, and from thence we might compute the quantity of their circular motions. And then, if any equal forces should be impressed at once on the alternate faces of the globes to augment or diminish their circular motions, from the increase or decrease of the tension of the cord we might infer the increment or decrement of their motions; and thence would be found on what faces those forces ought to be impressed that the motions of the globes might be most augmented; that is, we might discover their hindermost faces, or those which follow in the circular motion. But the faces which follow being known, and consequently the opposite ones that precede, we should likewise know the determination of their motions. And thus we might find both the quantity and determination of this circular motion, even in an immense vacuum, where there was nothing external or sensible, with which the globes might be compared. But now, if in that space some remote bodies were placed that kept always a given position one to another, as the fixed stars do in our regions; we could not indeed determine from the relative translation of the globes among those bodies, whether the motion did belong to the globes or to the bodies. But if we observed the cord, and found that its tension was that very tension which the motions of the globes required, we might conclude the motion to be in the globes, and the bodies to be at rest; and then, lastly, from the translation of the globes among the bodies, we should find the determination of their motions.

Having thus explained himself, Sir Isaac proposes to show how we are to collect the true motions from their causes, effects, and apparent differences; and *vice versa*, how, from the motions, either true or apparent, we may come to the knowledge of their causes and effects. In order to this, he lays down the following axioms or laws of motion.

11 Laws of motion.

1. EVERY BODY PERSEVERES IN ITS STATE OF REST, OR OF UNIFORM MOTION IN A RIGHT LINE, UNLESS IT IS COMPELLED TO CHANGE THAT STATE BY FORCES IMPRESSED UPON IT.—Sir Isaac's proof of this axiom is as follows: "Projectiles persevere in their motions, so far as they are not retarded by the resistance of the air, or impelled downwards by the force of gravity. A top, whose parts, by their cohesion, are perpetually drawn aside from rectilinear motions, does not cease its rotation otherwise than as it is retarded by the air. The greater bodies of the planets and comets, meeting with less resistance in more free spaces, preserve their motions, both progressive and circular, for a much longer time."—Notwithstanding this demonstration, however, the axiom hath been violently disputed. It hath been argued, that bodies continue in their state of motion because they are subjected to the continual impulse of an invisible and subtile fluid, which always pours in from behind, and of which all places are full. It hath been affirmed that motion is as natural to this fluid as rest is to all other matter. It is said, moreover, that it is impossible we can know in what manner a body would be influenced by moving forces if it was entirely destitute of gravity. According to what we can observe, the momentum of a body, or its tendency to move, depends very much on its gravity. A heavy cannon-ball will fly to a much greater distance than a light one, though both are actuated by an equal force. It is by no means clear, therefore, that a body totally destitute of gravity would have any proper momentum of its own; and if it had no momentum, it could not continue its motion for the smallest space of time after the moving power was withdrawn. Some have imagined that matter was capable of beginning motion of itself, and consequently that the axiom was false; because we see plainly that matter in some cases hath a tendency to-

12 Objections to the first law.

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to change from a state of motion to a state of rest, and from a state of rest to a state of motion. A paper appeared on this subject in the first volume of the Edinburgh Physical and Literary Essays; but the hypothesis never gained any ground.

2. THE ALTERATION OF MOTION IS EVER PROPORTIONAL TO THE MOTIVE FORCE IMPRESSED; AND IS MADE IN THE DIRECTION OF THE RIGHT LINE IN WHICH THAT FORCE IS IMPRESSED.—Thus, if any force generates a certain quantity of motion, a double force will generate a double quantity, whether that force be impressed all at once, or in successive moments. To this law no objection of consequence has ever been made. It is founded on this self-evident truth, that every effect must be proportional to its cause. Mr Young, who seems to be very ambitious of detecting the errors of Newton, finds fault indeed with the expressions in which the law is stated; but he owns, that if thus expressed, *The alteration of motion is proportional to the actions or resistances which produce it, and is in the direction in which the actions or resistances are made*, it would be unexceptionable.

13 Objections to the third law.

3. TO EVERY ACTION THERE ALWAYS IS OPPOSED AN EQUAL RE-ACTION: OR THE MUTUAL ACTION OF TWO BODIES UPON EACH OTHER ARE ALWAYS EQUAL, AND DIRECTED TO CONTRARY PARTS.—This axiom is also disputed by many. In the above-mentioned paper in the Physical Essays, the author endeavours to make a distinction between re-action and resistance; and the same attempt has been made by Mr Young. "When an action generates no motion (says he), it is certain that its effects have been destroyed by a contrary and equal action. When an action generates two contrary and equal motions, it is also evident that mutual actions were exerted, equal and contrary to each other. All cases where one of these conditions are not found, are exceptions to the truth of the law. If a finger presses against a stone, the stone, if it does not yield to the pressure, presses as much upon the finger: but if the stone yields, it re-acts less than the finger acts; and if it should yield with all the momentum that the force of the pressure ought to generate, which it would do if it were not impeded by friction, or a medium, it would not re-act at all. So if the stone drawn by a horse, follows after the horse, it does not re-act so much as the horse acts; but only so much as the velocity of the stone is diminished by friction, and it is the re-action of friction only, not of the stone. The stone does not re-act because it does not act, it resists, but resistance is not action.

"In the loss of motion from a striking body, equal to the gain in the body struck, there is a plain solution without requiring any re-action. The motion *lost* is identically that which is *found* in the other body; this supposition accounts for the whole phenomenon in the most simple manner. If it be not admitted, but the solution by re-action is insisted upon, it will be incumbent on the party to account for the whole effect of communication of motion; otherwise he will lie under the imputation of rejecting a solution which is simple, obvious, and perfect; for one complex, unnatural, and incomplete. However this may be determined, it will be allowed, that the circumstances mentioned, afford no ground for the inference, that action and re-action are equal, since appearances may be explained in another way" (A).

Others grant that Sir Isaac's axiom is very true in respect to terrestrial substances; but they affirm, that, in

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(A) If there be a perfect reciprocity betwixt an impinging body and a body at rest sustaining its impulse, may we not at our pleasure consider either body as the agent, and the other as the resistant? Let a moving body, A, pass from north to south, an equal body B at rest, which receives the stroke of A, act upon A from south to north, and A resist in a contrary direction, both inelastic: let the motion reciprocally communicated be called six. Then B at rest communicates to A six degrees of motion towards the north, and receives six degrees towards the south. B having no other motion than the six degrees it communicated, will, by its equal and contrary loss and gain, remain in equilibrio. Let the original motion of A have been twelve, then A having received a contrary action equal to six, six degrees of its motion will be destroyed or in equilibrio; consequently, a motive force as six will remain to A towards the south, and B will be in equilibrio, or at rest. A will then endeavour to move with six degrees, or half its original motion, and B will remain at rest as before. A and B being equal masses, by the laws of communication three degrees of motion will be communicated to B, or A with its six degrees will act with three, and B will re-act also with three. B then will act on A from south to north equal to three, while it is acted upon or resisted by A from north to south, equal also to three, and B will remain at rest as before; A will also have its six degrees of motion reduced to one half by the contrary action of B, and only three degrees of motion will remain to A, with which it will yet endeavour to move; and finding B still at rest, the same process will be repeated till the whole motion of A is reduced to an infinitely small quantity, B all the while remaining at rest, and there will be no communication of motion from A to B, which is contrary to experience.

Let a body, A, whose mass is twelve, at rest, be impinged upon first by B, having a mass as twelve, and a velocity as four, making a momentum of 48; and secondly by C, whose mass is six, and velocity eight, making a momentum of 48 equal to B, the three bodies being inelastic. In the first case, A will become possessed of a momentum of 24, and 24 will remain to B; and, in the second case, A will become possessed of a momentum of 32, and 16 will remain to C, both bodies moving with equal velocities after the shock, in both cases, by the laws of percussion. It is required to know, if in both cases A resists equally, and if B and C act equally? if the actions and resistances are equal, how does A in one case destroy 24 parts of B's motion, and in the other case 32 parts of C's motion, by an equal resistance? And how does B communicate in one case 24 degrees of motion, and C 32, by equal actions? If the actions and resistances are unequal, it is asked how the same mass can resist differently to bodies impinging upon it with equal momenta, and how bodies

in these, both action and re-action, are the effects of gravity. Substances void of gravity would have no momentum; and without this they could not act; they should be moved by the least force, and therefore could not resist or re-act. If therefore there is any fluid which is the cause of gravity, though such fluid could act upon terrestrial substances, yet these could not re-act upon it; because they have no force of their own, but depend entirely upon it for their momentum. In this manner, say they, we may conceive that the planets circulate, and all the operations of nature are carried on by means of a subtile fluid; which being perfectly active, and the rest of matter altogether passive, there is neither resistance nor loss of motion. See Motion.

From the preceding axiom Sir Isaac draws the following corollaries.

1. A body by two forces conjoined will describe the diagonal of a parallelogram in the same time that it would describe the sides by those forces apart.

2. Hence we may explain the composition of any one direct force out of any two oblique ones, viz. by making the two oblique forces the sides of a parallelogram, and the direct one the diagonal.

3. The quantity of motion, which is collected by taking the sum of the motions directed towards the same parts, and the difference of those that are directed to contrary parts, suffers no change from the action of bodies among themselves; because the motion which one body loses is communicated to another: and if we suppose friction and the resistance of the air to be absent, the motion of a number of bodies which mutually impelled one another would be perpetual, and its quantity always equal.

4. The common centre of gravity of two or more bodies does not alter its state of motion or rest by the actions of the bodies among themselves; and therefore the common centre of gravity of all bodies acting upon each other (excluding outward actions and impediments) is either at rest, or moves uniformly in a right line.

5. The motions of bodies included in a given space are the same among themselves, whether that space is at rest, or moves uniformly forward in a right line without any circular motion. The truth of this is evidently shown by the experiment of a ship; where all motions happen after the same manner, whether the ship is at rest, or proceeds uniformly forward in a straight line.

6. If bodies, anyhow moved among themselves, are urged in the direction of parallel lines by equal accelerative forces, they will all continue to move among themselves, after the same manner as if they had been urged by no such forces.

The whole of the mathematical part of the Newtonian philosophy depends on the following lemmas; of which the first is the principal.

Lem. I. Quantities, and the ratios of quantities, which in any finite time converge continually to equality, and before that time approach nearer the one to the other than by any given difference, become ultimately equal. If you deny it; suppose them to be ultimately unequal, and let D be their ultimate difference. Therefore they cannot approach nearer to equality than by that given difference D; which is against the supposition. Newtonian Philosophy.

14 Objections to the first lemma,

Concerning the meaning of this lemma philosophers are not agreed; and unhappily it is the very fundamental position on which the whole of the system rests. Many objections have been raised to it by people who supposed themselves capable of understanding it. They say, that it is impossible we can come to an end of any infinite series, and therefore that the word *ultimate* can in this case have no meaning. In some cases the lemma is evidently false. Thus, suppose there are two quantities of matter A and B, the one containing half a pound, and the other a third part of one. Let both be continually divided by 2; and though their ratio, or the proportion of the one to the other, doth not vary, yet the difference between them perpetually becomes less, as well as the quantities themselves, until both the difference and quantities themselves become less than any assignable quantity: yet the difference will never totally vanish, nor the quantities become equal, as is evident from the two following series.

$$\frac{1}{2}\ \frac{1}{4}\ \frac{1}{8}\ \frac{1}{16}\ \frac{1}{32}\ \frac{1}{64}\ \frac{1}{128}\ \frac{1}{256}\ \frac{1}{512}\ \frac{1}{1024},\ \&c.$$
$$\frac{1}{3}\ \frac{1}{6}\ \frac{1}{12}\ \frac{1}{24}\ \frac{1}{48}\ \frac{1}{96}\ \frac{1}{192}\ \frac{1}{384}\ \frac{1}{768}\ \frac{1}{1536},\ \&c.$$
$$\text{Diff.}\ \frac{1}{6}\ \frac{1}{12}\ \frac{1}{24}\ \frac{1}{48}\ \frac{1}{96}\ \frac{1}{192}\ \frac{1}{384}\ \frac{1}{768}\ \frac{1}{1536}\ \frac{1}{3072},\ \&c.$$

Thus we see, that though the difference is continually diminishing, and that in a very large proportion, there is no hope of its vanishing, or the quantities becoming equal. In like manner, let us take the proportions or ratios of quantities, and we shall be equally unsuccessful. Suppose two quantities of matter, one containing 8 and the other 10 pounds; these quantities already have to each other the ratio of 8 to 10, or of 4 to 5; but let us add 2 continually to each of them, and though the ratios continually come nearer to that of equality, it is in vain to hope for a perfect coincidence. Thus,

$$8\ \ 10\ \ 12\ \ 14\ \ 16\ \ 18\ \ 20\ \ 22\ \ 24,\ \&c.$$
$$10\ \ 12\ \ 14\ \ 16\ \ 18\ \ 20\ \ 22\ \ 24\ \ 26,\ \&c.$$
$$\text{Ratio}\ \frac{4}{5}\ \frac{5}{6}\ \frac{6}{7}\ \frac{7}{8}\ \frac{8}{9}\ \frac{9}{10}\ \frac{10}{11}\ \frac{11}{12}\ \frac{12}{13},\ \&c.$$

For this and his other lemmas Sir Isaac makes the answered. following apology. "These lemmas are premised, to avoid the tediousness of deducing perplexed demonstrations *ad absurdum*, according to the method of ancient geometers. For demonstrations are more contracted by the method of indivisibles: but because the hypothesis of indivisibles seems somewhat harsh, and therefore that method is reckoned less geometrical, I chose rather to reduce the demonstrations of the following propositions to the first and last sums and ratios of nascent and evanescent quantities, that is, to the limits of those sums and ratios; and so to premise, as short as I could, the demonstrations of those limits. For

bodies possessed of equal momenta can exert different actions, it being admitted that bodies resist proportional to their masses, and that their power of overcoming resistance is proportional to their momenta?

It is incumbent on those who maintain the doctrine of universal re-action, to free it from these difficulties and apparent contradictions.

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For hereby the same thing is performed as by the method of indivisibles; and now those principles being demonstrated, we may use them with more safety.—Therefore, if hereafter I should happen to consider quantities as made up of particles, or should use little curve lines for right ones; I would not be understood to mean indivisibles, but evanescent divisible quantities; not the sums and ratios of determinate parts, but always the limits of sums and ratios; and that the force of such demonstrations always depends on the method laid down in the foregoing lemmas.

"Perhaps it may be objected, that there is no ultimate proportion of evanescent quantities, because the proportion, before the quantities have vanished, is not the ultimate, and, when they are vanished, is none.—But by the same argument it may be alleged, that a body arriving at a certain place, and there stopping, has no ultimate velocity; because the velocity before the body comes to the place is not its ultimate velocity; when it is arrived, it has none. But the answer is easy: for by the ultimate velocity is meant that with which the body is moved, neither before it arrives at its place and the motion ceases, nor after; but at the very instant it arrives; that is, that velocity with which the body arrives at its last place, and with which the motion ceases. And in like manner, by the ultimate ratio of evanescent quantities is to be understood the ratio of the quantities, not before they vanish, nor afterwards, but with which they vanish. In like manner, the first ratio of nascent quantities is that with which they begin to be. And the first or last sum is that with which they begin and cease to be (or to be augmented and diminished). There is a limit which the velocity at the end of the motion may attain, but not exceed; and this is the ultimate velocity. And there is the like limit in all quantities and proportions that begin and cease to be. And, since such limits are certain and definite, to determine the same is a problem strictly geometrical. But whatever is geometrical we may be allowed to make use of in determining and demonstrating any other thing that is likewise geometrical.

"It may also be objected, that if the ultimate ratios of evanescent quantities are given, their ultimate magnitudes will be also given; and so all quantities will consist of indivisibles, which is contrary to what Euclid has demonstrated concerning incommensurables, in the 10th book of his Elements. But this objection is founded on a false supposition. For those ultimate ratios with which quantities vanish are not truly the ratios of ultimate quantities, but limits towards which the ratios of quantities decreasing continually approach."

Lem. II. If in any figure A*ac*E (Plate CCCXLV. N° 1.) terminated by the right line A*a*, AE, and the curve *ac*E, there be inscribed any number of parallelograms A*b*, B*c*, C*d*, &c. comprehended under equal bases AB, BC, CD, &c. and the sides B*b*, C*c*, D*d*, &c. parallel to one side A*a* of the figure; and the parallelograms *a*K*bl*, *b*L*cm*, *c*M*dn*, &c. are completed.—Then if the breadth of those parallelograms be supposed to be diminished, and their number augmented *in infinitum*; the ultimate ratios which the inscribed figure AK*b*L*c*M*d*D, the circumscribed figure A*albmcndo*E, and curvilinear figure A*abcd*E, will have to one another, are ratios of equality.—For the difference of the inscribed and circumscribed figures is the sum of the parallelograms K*l*, L*m*, M*n*, D*o*; that is (from the equality of all their bases), the rectangle under one of their bases K*b*, and the sum of their altitudes A*a*, that is, the rectangle AB*la*.—But this rectangle, because its breadth AB is supposed diminished *in infinitum*, becomes less than any given space. And therefore by Lem. I. the figures inscribed and circumscribed become ultimately equal the one to the other; and much more will the intermediate curvilinear figure be ultimately equal to either.

Lem. III. The same ultimate ratios are also ratios of equality, when the breadths AB, BC, CD, &c. of the parallelograms are unequal, and are all diminished *in infinitum*.—The demonstration of this differs but little from that of the former.

In his succeeding lemmas, Sir Isaac goes on to prove, in a manner similar to the above, that the ultimate ratios of the sine, chord, and tangent of arcs infinitely diminished, are ratios of equality, and therefore that in all our reasonings about these we may safely use the one for the other:—that the ultimate form of evanescent triangles made by the arc, chord, and tangent, is that of similitude, and their ultimate ratio is that of equality; and hence, in reasonings about ultimate ratios, we may safely use these triangles for each other, whether made with the sine, the arc, or the tangent.—He then shows some properties of the ordinates of curvilinear figures; and proves that the spaces which a body describes by any finite force urging it, whether that force is determinate and immutable, or is continually augmented or continually diminished, are, in the very beginning of the motion, one to the other in the duplicate ratio of the powers. And, lastly, Having added some demonstrations concerning the evanescence of angles of contact, he proceeds to lay down the mathematical part of his system, and which depends on the following theorems:

Theor. I. The areas which revolving bodies describe by radii drawn to an immoveable centre of force, lie in the same immoveable planes, and are proportional to the times in which they are described.—For, suppose the time to be divided into equal parts, and in the first part of that time, let the body by its innate force describe the right line AB (N° 2.); in the second part of that time, the same would, by Law 1. if not hindered, proceed directly to *c* along the line B*c*=AB; so that by the radii AS, BS, *c*S, drawn to the centre, the equal areas ASB, BS*c*, would be described. But, when the body is arrived at B, suppose the centripetal force acts at once with a great impulse, and turning aside the body from the right line B*c*, compels it afterwards to continue its motion along the right line BC. Draw *c*C parallel to BS, meeting BC in C; and at the end of the second part of the time, the body, by Cor. 1. of the Laws, will be found in C, in the same plane with the triangle ASB. Join SC; and because SB and *c*C are parallel, the triangle SBC will be equal to the triangle SBC, and therefore also to the triangle SAB. By the like argument, if the centripetal force acts successively in C, D, E, &c. and makes the body in each single particle of time to describe the right lines CD, DE,

EF, &c. they will all lie in the same plane; and the triangle SCD will be equal to the triangle SBC, and SDE to SCD, and SEF to SDE. And therefore, in equal times, equal areas are described in one immoveable plane; and, by composition, any sums SADS, SAFS, of those areas are, one to the other, as the times in which they are described. Now, let the number of those triangles be augmented, and their size diminished *in infinitum;* and then, by the preceding lemmas, their ultimate perimeter ADF will be a curve line: and therefore the centripetal force by which the body is perpetually drawn back from the tangent of this curve will act continually; and any described areas SADS, SAFS, which are always proportional to the times of description, will, in this case also, be proportional to those times Q. E. D.

Cor. 1. The velocity of a body attracted towards an immoveable centre, in spaces void of resistance, is reciprocally as the perpendicular let fall from that centre on the right line which touches the orbit. For the velocities in these places, A, B, C, D, E, are as the bases AB, BC, DE, EF, of equal triangles; and these bases are reciprocally as the perpendiculars let fall upon them.

Cor. 2. If the chords AB, BC, of two arcs, successively described in equal times by the same body, in spaces void of resistance, are completed into a parallelogram ABCV, and the diagonal BV of this parallelogram, in the position which it ultimately acquires when those arcs are diminished *in infinitum*, is produced both ways, it will pass through the centre of force.

Cor. 3. If the chords AB, BC, and DE, EF, of arcs described in equal times, in spaces void of resistance, are completed into the parallelograms ABCV, DEFZ, the forces in B and E are one to the other in the ultimate ratio of the diagonals BV, EZ, when those arcs are diminished *in infinitum*. For the motions BC and EF of the body (by Cor. 1. of the laws), are compounded of the motions B*c*, BV and E*f*, EZ; but BV and EZ, which are equal to C*c*= and F*f*, in the demonstration of this proposition, were generated by the impulses of the centripetal force in B and E, and are therefore proportional to those impulses.

Cor. 4. The forces by which bodies, in spaces void of resistance, are drawn back from rectilinear motions, and turned into curvilinear orbits, are one to another as the versed sines of arcs described in equal times; which versed sines tend to the centre of force, and bisect the chords when these arcs are diminished to infinity. For such versed sines are the halfs of the diagonals mentioned in Cor. 3.

Cor. 5. And therefore those forces are to the force of gravity, as the said versed sines to the versed sines perpendicular to the horizon of those parabolic arcs which projectiles describe in the same time.

Cor. 6. And the same things do all hold good (by Cor. 5. of the laws) when the planes in which the bodies are moved, together with the centres of force, which are placed in those planes, are not at rest, but move uniformly forward in right lines.

Theor. II. Every body that moves in any curve line described in a plane, and, by a radius drawn to a point either immoveable or moving forward with an uniform rectilinear motion, describes about that point areas proportional to the times, is urged by a centripetal force directed to that point.

Case I. For every body that moves in a curve line is (by Law 1.) turned aside from its rectilinear course by the action of some force that impels it; and that force by which the body is turned off from its rectilinear course, and made to describe in equal times the least equal triangles SAB, SBC, SCD, &c. about the immoveable point S, (by Prop. 40. E. 1. and Law 2.) acts in the place B according to the direction of a line parallel to C; that is, in the direction of the line BS; and in the place C according to the direction of a line parallel to *d* D, that is, in the direction of the line CS, &c.; and therefore acts always in the direction of lines tending to the immoveable point S. Q. E. D.

Case II. And (by Cor. 5. of the laws) it is indifferent whether the superficies in which a body describes a curvilinear figure be quiescent, or moves together with the body, the figure described, and its point S, uniformly forward in right lines.

Cor. 1. In non-resisting spaces or mediums, if the the areas are not proportional to the times, the forces are not directed to the point in which the radii meet; but deviate therefrom *in consequentia*, or towards the parts to which the motion is dirjected, if the description of the areas is accelerated; but *in antecedentia* if retarded.

Cor. 2. And even in resisting mediums, if the description of the areas is accelerated, the directions of the forces deviate from the point in which the radii meet, towards the parts to which the motion tends.

Scholium.

A body may be urged by a centripetal force compounded of several forces. In which case the meaning of the proposition is, that the force which results out of all tends to the point S. But if any force acts perpetually in the direction of lines perpendicular to the described surface, this force will make the body to deviate from the plane of its motion, but will neither augment nor diminish the quantity of the described surface; and is therefore not to be neglected in the composition of forces.

Theor. III. Every body that, by a radius drawn to the centre of another body, howsoever moved, describes areas about that centre proportional to the times, is urged by a force compounded of the centripetal forces tending to that other body, and of all the accelerative force by which that other body is impelled.—The demonstration of this is a natural consequence of the theorem immediately preceding.

Hence, if the one body L, by a radius drawn to the other body T, describes areas proportional to the times, and from the whole force by which the first body L is urged, (whether that force is simple, or, according to Cor. 2. of the laws, compounded of several forces), we subduct that whole accelerative force by which the other body is urged; the whole remaining force by which the first body is urged will tend to the other body T, as its centre.

And *vice versa*, if the remaining force tends nearly to the other body T, those areas will be nearly proportional to the times.



If

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If the body L, by a radius drawn to the other body T, describes areas, which, compared with the times, are very unequal, and that other body T be either at rest, or moves uniformly forward in a right line, the action of the centripetal force tending to that other body T is either none at all, or it is mixed and combined with very powerful actions of other forces: and the whole force compounded of them all, if they are many, is directed to another (immoveable or moveable) centre. The same thing obtains when the other body is actuated by any other motion whatever; provided that centripetal force is taken which remains after subducting that whole force acting upon that other body T.

SCHOLIUM.

Because the equable description of areas indicates that a centre is respected by that force with which the body is most affected, and by which it is drawn back from its rectilinear motion, and retained in its orbit, we may always be allowed to use the equable description of areas as an indication of a centre about which all circular motion is performed in free spaces.

THEOR. IV. The centripetal forces of bodies which by equable motions describe different circles, tend to the centres of the same circles; and are one to the other as the squares of the arcs described in equal times applied to the radii of circles.—For these forces tend to the centres of the circles, (by Theor. 2. and Cor. 2. Theor. 1.) and are to one another as the versed sines of the least arcs described in equal times, (by Cor. 4. Theor. 1.) that is, as the squares of the same arcs applied to the diameters of the circles, by one of the lemmas; and therefore, since those arcs are as arcs described in any equal times, and the diameters are as the radii, the forces will be as the squares of any arcs described in the same time, applied to the radii of the circles. Q. E. D.

COR. 1. Therefore, since those arcs are as the velocities of the bodies, the centripetal forces are in a ratio compounded of the duplicate ratio of the velocities directly, and of the simple ratio of the radii inversely.

COR. 2. And since the periodic times are in a ratio compounded of the ratio of the radii directly, and the ratio of the velocities inversely; the centripetal forces are in a ratio compounded of the ratio of the radii directly, and the duplicate ratio of the periodic times inversely.

COR. 3. Whence, if the periodic times are equal, and the velocities therefore as the radii, the centripetal forces will be also as the radii; and the contrary.

COR. 4. If the periodic times and the velocities are both in the subduplicate ratio of the radii, the centripetal forces will be equal among themselves; and the contrary.

COR. 5. If the periodic times are as the radii, and therefore the velocities equal, the centripetal forces will be reciprocally as the radii; and the contrary.

COR. 6. If the periodic times are in the sesquiplicate ratio of the radii, and therefore the velocities reciprocally in the subduplicate ratio of the radii, the centripetal forces will be in the duplicate ratio of the radii inversely; and the contrary.

COR. 7. And universally, if the periodic time is as any power $R^n$ of the radius R, and therefore the velocity reciprocally as the power $R^{n-1}$ of the radius, the centripetal force will be reciprocally as the power $R^{2n-1}$ of the radius; and the contrary.

COR. 8. The same things all hold concerning the times, the velocities, and forces, by which bodies describe the similar parts of any similar figures, that have their centres in a similar position within those figures, as appears by applying the demonstrations of the preceding cases to those. And the application is easy, by only substituting the equable description of areas in the place of equable motion, and using the distances of the bodies from the centres instead of the radii.

COR. 9. From the same demonstration it likewise follows, that the arc which a body uniformly revolving in a circle by means of a given centripetal force describes in any time, is a mean proportional between the diameter of the circle, and the space which the same body, falling by the same given force, would descend through in the same given time.

"By means of the preceding proposition and its corollaries (says Sir Isaac), we may discover the proportion of a centripetal force to any other known force, such as that of gravity. For if a body by means of its gravity revolves in a circle concentric to the earth, this gravity is the centripetal force of that body. But from the descent of heavy bodies, the time of one entire revolution, as well as the arc described in any given time, is given (by Cor. 9. of this theorem). And by such propositions Mr Huygens, in his excellent book *De Horologio Oscillatorio*, has compared the force of gravity with the centrifugal forces of revolving bodies.

The preceding proposition may also be demonstrated in the following manner. In any circle suppose a polygon to be inscribed of any number of sides. And if a body, moved with a given velocity along the sides of the polygon, is reflected from the circle at the several angular points; the force with which, at every reflection it strikes the circle, will be as its velocity: and therefore the sum of the forces, in a given time, will be as that velocity and the number of reflections conjunctly; that is, (if the species of the polygon be given), as the length described in that given time, and increased or diminished in the ratio of the same length to the radius of the circle; that is, as the square of that length applied to the radius; and therefore, if the polygon, by having its sides diminished *in infinitum*, coincides with the circle, as the square of the arc described in a given time applied to the radius. This is the centrifugal force, with which the body impels the circle; and to which the contrary force, wherewith the circle continually repels the body towards the centre, is equal.

On these principles hangs the whole of Sir Isaac Newton's mathematical philosophy. He now shows how to find the centre to which the forces impelling any body are directed, having the velocity of the body given: and finds the centrifugal force to be always as the versed sine of the nascent arc directly, and as the square

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square of the time inversely; or directly as the square of the velocity, and inversely as the chord of the nascent arc. From these premises he deduces the method of finding the centripetal force directed to any given point when the body revolves in a circle; and this whether the central point is near or at an immense distance; so that all the lines drawn from it may be taken for parallels. The same thing he shows with regard to bodies revolving in spirals, ellipses, hyperbolas, or parabolas.—Having the figures of the orbits given, he shows also how to find the velocities and moving powers; and, in short, solves all the most difficult problems relating to the celestial bodies with an astonishing degree of mathematical skill. These problems and demonstrations are all contained in the first book of the *Principia:* but to give an account of them here would far exceed our limits; neither would many of them be intelligible, excepting to first-rate mathematicians.

16 Rules for philosophical reasoning.

In the second book, Sir Isaac treats of the properties of fluids, and their powers of resistance; and here he lays down such principles as entirely overthrow the doctrine of Des Cartes's vortices, which was the fashionable system in his time. In the third book, he begins particularly to treat of the natural phenomena, and apply them to the mathematical principles formerly demonstrated; and, as a necessary preliminary to this part, he lays down the following rules for reasoning in natural philosophy.

1. We are to admit no more causes of natural things than such as are both true and sufficient to explain their natural appearances.

2. Therefore to the same natural effects we must always assign, as far as possible, the same causes.

3. The qualities of bodies which admit neither intension nor remission of degrees, and which are found to belong to all bodies within the reach of our experiments, are to be esteemed the universal qualities of all bodies whatsoever.

4. In experimental philosophy, we are to look upon propositions collected by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions.

The phenomena first considered are, 1. That the satellites of Jupiter by radii drawn to the centre of their primary, describe areas proportional to the times of their description; and that their periodic times, the fixed stars being at rest, are in the sesquiplicate ratio of their distances from its centre. 2. The same thing is likewise observed of the phenomena of Saturn. 3. The five primary planets, Mercury, Venus, Mars, Jupiter, and Saturn, with their several orbits encompass the sun. 4. The fixed stars being supposed at rest, the periodic times of the five primary planets, and of the earth, about the sun, are in the sesquiplicate proportion of their mean distances from the sun. 5. The primary planets, by radii drawn to the earth, describe areas no ways proportionable to the times: but the areas which they describe by radii drawn to the sun are proportional to the times of description. 6. The moon, by a radius drawn to the centre of the earth, describes an area proportional to the time of description. All these phenomena are undeniable from astronomical observations, and are explained at large under the article Astronomy. The mathematical demonstrations are next applied by Sir Isaac Newton in the following propositions:

Prop. I. The forces by which the satellites of Jupiter are continually drawn off from rectilinear motions, and retained in their proper orbits, tend to the centre of that planet; and are reciprocally as the squares of the distances of those satellites from that centre. The former part of this proposition appears from Theor. 2. or 3. and the latter from Cor. 6. of Theor. 5.; and the same thing we are to understand of the satellites of Saturn.

Prop. II. The forces by which the primary planets are continually drawn off from rectilinear motions, and retained in their proper orbits, tend to the sun; and are reciprocally as the squares of the distances from the sun's centre. The former part of this proposition is manifest from Phenomenon 5. just mentioned, and from Theor. 2.; the latter from Phenomenon 4. and Cor. 6. of Theor. 4. But this part of the proposition is with great accuracy deducible from the quiescence of the aphelion points. For a very small aberration from the reciprocal duplicate proportion would produce a motion of the apsides, sensible in every single revolution, and in many of them enormously great.

Prop. III. The force by which the moon is retained in its orbit, tends towards the earth; and is reciprocally as the square of the distance of its place from the centre of the earth. The former part of this proposition is evident from Phenom. 5. and Theor. 2.; the latter from Phenom. 6. and Theor. 2. or 3. It is also evident from the very slow motion of the moon's apogee; which, in every single revolution, amounting but to 3° 3′ *in consequentia*, may be neglected: and this more fully appears from the next proposition.

Prop. IV. The moon gravitates towards the earth, and by the force of gravity is continually drawn off from a rectilinear motion, and retained in its orbit.—The mean distance of the moon from the earth in the syzigies in semidiameters of the latter, is about $60\frac{1}{2}$. Let us assume the mean distance of 60 semidiameters in the syzigies; and suppose one revolution of the moon in respect of the fixed stars to be completed in $27^d. 7^h. 43'$, as astronomers have determined; and the circumference of the earth to amount to 123,249,600 Paris feet. Now, if we imagine the moon, deprived of all motion, to be let go, so as to descend towards the earth with the impulse of all that force by which it is retained in its orbit, it will, in the space of one minute of time, describe in its fall $15\frac{1}{12}$ Paris feet. For the versed sine of that arc which the moon, in the space of one minute of time, describes by its mean motion at the distance of 60 semidiameters of the earth, is nearly $15\frac{1}{12}$ Paris feet; or more accurately, 15 feet 1 inch and one line $\frac{4}{9}$. Wherefore since that force, in approaching to the earth, increases in the reciprocal duplicate proportion of the distance; and, upon that account, at the surface of the earth is 60×60 times greater than that at the moon; a body in our regions, falling with that force, ought, in the space of one minute of time, to describe $60\times60\times15\frac{1}{12}$ Paris feet; and in the space of one second of time to describe $15\frac{1}{12}$ of those feet; or, more accurately, 15 feet 1 inch,

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1 inch, 1 line $\frac{4}{9}$. And with this very force we actually find that bodies here on earth do really descend.—For a pendulum oscillating seconds in the latitude of Paris, will be three Paris feet and $8\frac{1}{2}$ lines in length, as Mr Huygens has observed. And the space which a heavy body describes by falling one second of time is to half the length of the pendulum in the duplicate ratio of the circumference of the circle to its diameter; and is therefore 15 Paris feet, 1 inch 1 line $\frac{7}{9}$. And therefore the force by which the moon is retained in its orbit, becomes at the very surface of the earth, equal to the force of gravity which we observe in heavy bodies there. And therefore (by Rule 1. and 2.) the force by which the moon is retained in its orbit is that very same force which we commonly call *gravity*. For were gravity another force different from that, then bodies descending to the earth with the joint impulse of both forces would fall with a double velocity, and, in the space of one second of time, would describe $30\frac{1}{6}$ Paris feet; altogether against experience.

The demonstration of this proposition may be more diffusely explained after the following manner: Suppose several moons to revolve about the earth, as in the system of Jupiter or Saturn, the periodic times of those moons would (by the argument of induction) observe the same law which Kepler found to obtain among the planets; and therefore their centripetal forces would be reciprocally as the squares of the distances from the centre of the earth, by Prop. I. Now, if the lowest of these were very small, and were so near the earth as almost to touch the tops of the highest mountains, the centripetal force thereof, retaining it in its orbit, would be very nearly equal to the weights of any terrestrial bodies that should be found upon the tops of these mountains; as may be known from the foregoing calculation. Therefore, if the same little moon should be deserted by its centrifugal force that carries it through its orbit, it would descend to the earth; and that with the same velocity as heavy bodies do actually descend with upon the tops of those very mountains, because of the equality of forces that oblige them both to descend. And if the force by which that lowest moon would descend were different from that of gravity, and if that moon were to gravitate towards the earth, as we find terrestrial bodies do on the tops of mountains, it would then descend with twice the velocity, as being impelled by both these forces conspiring together. Therefore, since both these forces, that is, the gravity of heavy bodies, and the centripetal forces of the moons, respect the centre of the earth, and are similar and equal between themselves, they will (by Rule 1. and 2.) have the same cause. And therefore the force which retains the moon in its orbit, is that very force which we commonly call *gravity*; because otherwise, this little moon at the top of a mountain must either be without gravity, or fall twice as swiftly as heavy bodies use to do.

Having thus demonstrated that the moon is retained in its orbit by its gravitation towards the earth, it is easy to apply the same demonstration to the motions of the other secondary planets, and of the primary planets round the sun, and thus to show that gravitation prevails throughout the whole creation; after which, Sir Isaac proceeds to show from the same principles that the heavenly bodies gravitate towards each other, and contain different quantities of matter, or have different densities in proportion to their bulks.

Prop. V. All bodies gravitate towards every planet; and the weights of bodies towards the same planet, at equal distances from its centre, are proportional to the quantities of matter they contain.

It has been confirmed by many experiments, that all sorts of heavy bodies (allowance being made for the inequality of retardation by some small resistance of the air,) descend to the earth from equal heights in equal times; and that equality of times we may distinguish to a great accuracy by the help of pendulums. Sir Isaac Newton tried the thing in gold, silver, lead, glass, sand, common salt, wood, water, and wheat. He provided two wooden boxes, round and equal; filled the one with wood, and suspended an equal weight of gold in the centre of oscillation of the other. The boxes hanging by equal threads of 11 feet, made a couple of pendulums, perfectly equal in weight and figure, and equally receiving the resistance of the air. And placing the one by the other, he observed them to play together forwards and backward, for a long time, with equal vibrations. And therefore the quantity of matter in the gold was to the quantity of matter in the wood, as the action of the motive force (or *vis motrix*) upon all the gold, to the action of the same upon all the wood; that is, as the weight of the one to the weight of the other. And the like happened in the other bodies. By these experiments, in bodies of the same weight, he could manifestly have discovered a difference of matter less than the thousandth part of the whole, had any such been. But without all doubt, the nature of gravity towards the planets, is the same as towards the earth. For should we imagine our terrestrial bodies removed to the orb of the moon, and there, together with the moon, deprived of all motion, to be let go, so as to fall together towards the earth; it is certain, from what we have demonstrated before, that in equal times, they would describe equal spaces with the moon, and of consequence are to the moon in quantity of matter, as their weights to its weight. Moreover, since the satellites of Jupiter perform their revolutions in times which observe the sesquiplicate proportion of their distances from Jupiter's centre, their accelerative gravities towards Jupiter will be reciprocally as the squares of their distances from Jupiter's centre; that is, equal at equal distances. And therefore, these satellites, if supposed to fall towards Jupiter from equal heights, would describe equal spaces in equal times, in like manner as heavy bodies do on our earth. And by the same argument if the circumsolar planets were supposed to be let fall at equal distances from the sun, they would, in their descent towards the sun, describe equal spaces in equal times. But forces, which equally accelerate unequal bodies, must be as those bodies: that is to say, the weights of the planets towards the sun must be as their quantities of matter. Further, That the weights of Jupiter and his satellites towards the sun are proportional to the several quantities of their matter, appears from the exceeding regular motions of the satellites. For if some of these bodies were more strongly attracted to the sun in proportion to their quantity of matter than others, the motions of the satellites would be disturbed by that inequality of attraction. If, at equal

equal distances from the sun, any satellite, in proportion to the quantity of its matter, did gravitate towards the sun, with a force greater than Jupiter in proportion to his, according to any given proportion, suppose of *d* to *e*; then the distance between the centres of the sun and of the satellite's orbit would be always greater than the distance between the centres of the sun and of Jupiter nearly in the subduplicate of that proportion. And if the satellite gravitated towards the sun with a force less in the proportion of *e* to *d*, the distance of the centre of the satellite's orb from the sun would be less than the distance of the centre of Jupiter's from the sun in the subduplicate of the same proportion. Therefore, if, at equal distances from the sun, the accelerative gravity of any satellite towards the sun were greater or less than the accelerating gravity of Jupiter towards the sun but by $\frac{1}{1000}$ part of the whole gravity; the distance of the centre of the satellite's orbit from the sun would be greater or less than the distance of Jupiter from the sun by $\frac{1}{2000}$ part of the whole distance; that is, by a fifth part of the distance of the utmost satellite from the centre of Jupiter; an eccentricity of the orbit which would be very sensible. But the orbits of the satellites are concentric to Jupiter; therefore the accelerative gravities of Jupiter, and of all its satellites, towards the sun, are equal among themselves. And by the same argument, the weight of Saturn and of his satellites towards the sun, at equal distances from the sun, are as their several quantities of matter; and the weights of the moon and of the earth towards the sun, are either none, or accurately proportional to the masses of matter which they contain.

But further, the weights of all the parts of every planet towards any other planet are one to another as the matter in the several parts. For if some parts gravitated more, others less, than in proportion to the quantity of their matter; then the whole planet, according to the sort of parts with which it most abounds, would gravitate more or less than in proportion to the quantity of matter in the whole. Nor is it of any moment whether these parts are external or internal. For if, as an instance, we should imagine the terrestrial bodies with us to be raised up to the orb of the moon, to be there compared with its body; if the weights of such bodies were to the weights of the external parts of the moon as the quantities of matter in the one and in the other respectively, but to the weights of the internal parts in a greater or less proportion; then likewise the weights of those bodies would be to the weight of the whole moon in a greater or less proportion; against what we have showed above.

Cor. 1. Hence the weights of bodies do not depend upon their forms and textures. For if the weights could be altered with the forms, they would be greater or less, according to the variety of forms in equal matter; altogether against experience.

Cor. 2. Universally, all bodies about the earth gravitate towards the earth; and the weights of all, at equal distances from the earth's centre, are as the quantities of matter which they severally contain. This is the quality of all bodies within the reach of our experiments; and therefore (by Rule 3.) to be affirmed of all bodies whatsoever. If ether, or any other body, were either altogether void of gravity, or were to gravitate less in proportion to its quantity of matter; then, because (according to Aristotle, Des Cartes, and others) there is no difference betwixt that and other bodies, but in mere form of matter, by a successive change from form to form, it might be changed at last into a body of the same condition with those which gravitate most in proportion to their quantity of matter; and, on the other hand, the heaviest bodies, acquiring the first form of that body, might by degrees quite lose their gravity. And therefore the weights would depend upon the forms of bodies, and with those forms might be changed, contrary to what was proved in the preceding corollary.

Cor. 3. All spaces are not equally full. For if all spaces were equally full, then the specific gravity of the fluid which fills the region of the air, on account of the extreme density of the matter, would fall nothing short of the specific gravity of quicksilver or gold, or any other the most dense body; and therefore, neither gold, nor any other body, could descend in air. For bodies do not descend in fluids, unless they are specifically heavier than the fluids. And if the quantity of matter in a given space can by any rarefaction be diminished, what should hinder a diminution to infinity?

Cor. 4. If all the solid particles of all bodies are of the same density, nor can be rarefied without pores, a void space or vacuum must be granted. [By bodies of the same density, our author means those whose *vires inertiæ* are in the proportion of their bulks.]

Prop. VI. That there is a power of gravity tending to all bodies, proportional to the several quantities of matter which they contain.

That all the planets mutually gravitate one towards another, we have proved before; as well as that the force of gravity towards every one of them, considered apart, is reciprocally as the square of the distance of places from the centre of the planet. And thence it follows, that the gravity tending towards all the planets is proportional to the matter which they contain.

Moreover, since all the parts of any planet *A* gravitate towards any other planet *B*, and the gravity of every part is to the gravity of the whole as the matter of the part to the matter of the whole; and (by Law 3.) to every action corresponds an equal re-action: therefore the planet *B* will, on the other hand, gravitate towards all the parts of the planet *A*; and its gravity towards any one part will be to the gravity towards the whole, as the matter of the part to the matter of the whole. *Q. E. D.*

Cor. 1. Therefore the force of gravity towards any whole planet, arises from, and is compounded of, the forces of gravity towards all its parts. Magnetic and electric attractions afford us examples of this. For all attraction towards the whole arises from the attractions towards the several parts. The thing may be easily understood in gravity, if we consider a greater planet as formed of a number of lesser planets, meeting together in one globe. For hence it would appear that the force of the whole must arise from the forces of the component parts. If it be objected, that, according to this law, all bodies with us must mutually gravitate one towards another, whereas no such gravitation any-where appears; it is answered, that, since the gravitation towards these bodies is to the gravitation towards the whole earth, as these bodies are to the whole earth, the gravitation towards them must be far less than to fall

 fall under the obfervation of our fenfes. [The experiments with regard to the attraction of mountains, however, have now further elucidated this point.]

Cor. 2. The force of gravity towards the feveral equal particles of any body, is reciprocally as the fquare of the diftance of places from the particles.

Prop. VII. In two fpheres mutually gravitating each towards the other, if the matter, in places on all fides round about and equidiftant from the centres, is fimilar; the weight of either fphere towards the other will be reciprocally as the fquare of the diftance between their centres.

For the demonftration of this, fee the *Principia*, Book I. Prop. lxxv. and lxxvi.

Cor. 1. Hence we may find and compare together the weights of bodies towards different planets. For the weights of bodies revolving in circles about planets are as the diameters of the circles directly, and the fquares of their periodic times reciprocally; and their weights at the furfaces of the planets, or at any other diftances from their centres, are (by this prop.) greater or lefs, in the reciprocal duplicate proportion of the diftances. Thus from the periodic times of Venus, revolving about the fun, in 224d. $16\frac{3}{4}$h.; of the utmoft circumjovial fatellite revolving about Jupiter, in 16d. $16\frac{8}{15}$h.; of the Huygenian fatellite about Saturn in 15d. $22\frac{2}{3}$h.; and of the moon about the earth in 27d. 7h. 43′; compared with the mean diftance of Venus from the fun, and with the greateft heliocentric elongations of the outmoft circumjovial fatellite from Jupiter's centre, 8′ 16″; of the Huygenian fatellite from the centre of Saturn, 3′ 4″; and of the moon from the earth, 10′ 33″; by computation our author found, that the weight of equal bodies, at equal diftances from the centres of the fun, of Jupiter, of Saturn, and of the earth, towards the fun, Jupiter, Saturn, and the earth, were one to another as $\frac{1}{1067}$, $\frac{1}{3021}$, and $\frac{1}{169282}$ refpectively. Then, becaufe as the diftances are increafed or diminifhed, the weights are diminifhed or increafed in a duplicate ratio; the weights of equal bodies towards the fun, Jupiter, Saturn, and the earth, at the diftances 10000, 997, 791, and 109, from their centres, that is, at their very fuperficies, will be as 10000, 943, 529, and 435 refpectively.

Cor. 2. Hence likewife we difcover the quantity of matter in the feveral planets. For their quantities of matter are as the forces of gravity at equal diftances from their centres, that is, in the fun, Jupiter, Saturn, and the earth, as 1, $\frac{1}{1067}$, $\frac{1}{3021}$, and $\frac{1}{169282}$, refpectively. If the parallax of the fun be taken greater or lefs than 10″ 30‴, the quantity of matter in the earth muft be augmented or diminifhed in the triplicate of that proportion.

Cor. 3. Hence alfo we find the denfities of the planets. For (by Prop. lxxii. Book I.) the weights of equal and fimilar bodies towards fimilar fpheres, are, at the furfaces of thofe fpheres, as the diameters of the fpheres. And therefore the denfities of diffimilar fpheres are as thofe weights applied to the diameters of the fpheres. But the true diameters of the fun, Jupiter, Saturn, and the earth, were one to another as 10000, 997, 791, and 109; and the weights towards the fame, as 10000, 943, 529, and 435 refpectively; and therefore their denfities are as 100, $94\frac{1}{2}$, 67, and 400. The denfity of the earth, which comes out by this computation, does not depend upon the parallax of the fun, but it is determined by the parallax of the moon, and therefore is here truly defined. The fun therefore is a little denfer than Jupiter, and Jupiter than Saturn, and the earth four times denfer than the fun; for the fun, by its great heat, is kept in a fort of a rarefied ftate. The moon alfo is denfer than the earth. 

Cor. 4. The fmaller the planets are, they are, *cæteris paribus*, of fo much the greater denfity. For fo the powers of gravity on their feveral furfaces come nearer to equality. They are likewife, *cæteris paribus*, of the greater denfity as they are nearer to the fun. So Jupiter is more denfe than Saturn, and the earth than Jupiter. For the planets were placed at different diftances from the fun, that, according to their degrees of denfity, they might enjoy a greater or lefs proportion of the fun's heat. Our water, if it were removed as far as the orb of Saturn, would be converted into ice, and in the orb of Mercury would quickly fly away in vapour. For the light of the fun, to which its heat is proportional, is feven times denfer in the orb of Mercury than with us: and by the thermometer Sir Ifaac found, that a feventold heat of our fummer fun will make water boil. Nor are we to doubt, that the matter of Mercury is adapted to its heat, and is therefore more denfe than the matter of our earth; fince, in a denfer matter, the operations of nature require a ftronger heat.

It is fhown in the fcholium of Prop. xxii. Book II. of the *Principia*, that, at the height of 200 miles above the earth, the air is more rare than it is at the fuperficies of the earth, in the ratio of 30 to 0,0000000000003998, or as 75,000000000000 to 1 nearly. And hence the planet Jupiter, revolving in a medium of the fame denfity with that fuperior air, would not lofe by the refiftance of the medium the 1000000th part of its motion in 1000000 years. In the fpaces near the earth, the refiftance is produced only by the air, exhalations, and vapours. When thefe are carefully exhaufted by the air pump from under the receiver, heavy bodies fall within the receiver with perfect freedom, and without the leaft fenfible refiftance; gold itfelf, and the lighteft down, let fall together, will defcend with equal velocity; and though they fall through a fpace of four, fix, and eight feet, they will come to the bottom at the fame time; as appears from experiments that have often been made. And therefore the celeftial regions being perfectly void of air and exhalations, the planets and comets meeting no fenfible refiftance in thofe fpaces, will continue their motions through them for an immenfe fpace of time.

Newton (Richard) D. D. the founder of Hertford college, is a man of whom we regret that we can give but a fuperficial and rather a vague account. By one writer he is faid to have been a Northamptonfhire gentleman; by another, we are told that his father enjoyed at Lavendon Grange in Bucks a moderate eftate, which is ftill in the family, though he lived in a houfe of Lord Northampton's in Yardley-Chafe, where in 1675 our doctor was born. All agree that the family from which he fprung had long been refpectable, though its fortunes had been much injured during the great rebellion.

The fubject of this article was educated at Weftminfter fchool, and from that foundation elected to a ftudentfhip of Chrift-Church, Oxford. At what age he

 he was admitted into the university we have no certain information; but in the list of graduates he is thus distinguished: "Newton (Richard,) Christ-church, M. A. April 12. 1701; B. D. March 18. 1707; Hart-hall, D. D. December 7. 1710." He was appointed a tutor in Christ-church as soon as he was of the requisite standing in his college, and discharged the duties of that important office with honour to himself and advantage to the society of which he was a member. From Oxford he was called (we know not at what precise period) into Lord Pelham's family, to superintend the education of the late duke of Newcastle and his brother Mr Pelham; and by both these illustrious persons he was ever remembered with the most affectionate regard. In 1710 he was by Dr Aldrich, the celebrated dean of Christ-church, inducted principal of Hart-hall, which was then an appendage to Exeter college. From this state of dependance Dr Newton wrested it against much opposition, especially from the learned Dr Conybeare, afterwards dean of Christ-church and bishop of Bristol. In no contest, it has been observed, were ever two men more equally matched; and the papers that passed between them, like Junius's letters, deserved to be collected for the energetic beauty of their style and the ingenuity of their arguments. Dr Newton, however, proved successful; and in 1740 obtained a charter, converting Hart-hall into Hertford college; of which, at a considerable expence to himself, and with great aid from his numerous friends, he was thus the founder and first head.

Though this excellent man was Mr Pelham's tutor, and, if report be true, had by him been more than once employed to furnish king's speeches, he never received the smallest preferment from his pupil when first minister: and when that statesman was asked, why he did not place in a proper station the able and meritorious Dr Newton? his reply was, "How could I do it? he never asked me." He was not, however, neglected by all the great. Dr Compton, bishop of London, who had a just sense of his merits, had, at an early period of his life, collated him to the rectory of Sudbury in the county of Northampton, which he held together with the headship of Hart-hall. He resided for some years on that living, and discharged all the parts of his office with exemplary care and fidelity. Amongst other particulars he read the prayers of the liturgy in his church at seven o'clock in the evening of every week-day (hay-time and harvest excepted), for the benefit of such of his parishioners as could then assemble for public devotion. When he left the place, returning again to Oxford about 1724, he enjoined his curates to observe the same pious practice; and was fortunate enough to have three successively who trode in the steps of their worthy principal. Being always an enemy to pluralities with cure of souls, he exerted his utmost endeavours from time to time with Dr Gibson, Bishop Compton's successor in the see of London, for leave to resign his rectory in favour of his curate. To the resignation his lordship could have no objection; but being under some kind of engagement to confer the living on another, Dr Newton retained it himself, but bestowed all the emoluments upon works of charity in the parish, and curates who so faithfully discharged their duty. Dr Sherlock, who succeeded Bishop Gibson, being under no engagement of a like nature, very readily granted Dr Newton's request, by accepting his resignation, and collating to the rectory Mr Saunders, who was the last of his curates. Upon a vacancy of the public orator's place at Oxford, the head of Hertford college offered himself a candidate; but as the race is not always to the swift, nor the battle to the strong, Dr Digby Coates carried the point against him. He was afterwards promoted to a canonry of Christ-church, but did not long enjoy it; for in April 1753 death deprived the world of this excellent man in the 78th year of his age. 

He was allowed to be as polite a scholar, and as accomplished a gentleman, as almost any of the age in which he lived. In closeness of argument, and perspicuity of style, he had no superior. Never was any private person employed in more trusts, nor were trusts ever discharged with greater integrity. He was a zealous friend to religion, the university, the clergy, and the poor; and such was his liberality of sentiment, that he admitted to his friendship every man, whatever might be his religious creed, who was earnestly employed in the same good works with himself—the promotion of virtue and unaffected piety. Of his works we have seen only his *Theophrastus*, which was published after his death; and his *Pluralities Indefensible*; but he published several other things during his life, and left a volume of sermons prepared for the press at his death.

NEWTON (Thomas), late lord bishop of Bristol and dean of St Paul's, London, was born on the first of January 1704. His father, John Newton, was a considerable brandy and cyder merchant, who, by his industry and integrity, having acquired what he thought a competent fortune, left off trade several years before he died.

He received the first part of his education in the free school of Litchfield; a school which, the bishop observes with some kind of exultation, had at all times sent forth several persons of note and eminence; from Bishop Smaldridge and Mr Wollaston, to Dr Johnson and Mr Garrick.

From Litchfield he was removed to Westminster school, in 1717, under the care of Dr Friend and Dr Nicoll.

During the time he was at Westminster, there were, he observes, more young men who made a distinguished figure afterwards in the world, than perhaps at any other period, either before or since. He particularly mentions William Murray, the late earl of Mansfield, with whom he lived on terms of the highest friendship to the last.

He continued six years at Westminster school, five of which he passed in the college. He afterwards went to Cambridge, and entered at Trinity college. Here he constantly resided eight months at least in every year, till he had taken his Bachelor of Arts degree. Being chosen Fellow of his college, he came afterwards to settle in London. As it had been his inclination from a child, and as he was also designed for holy orders, he had sufficient time to prepare himself, and composed some sermons, that he might have a stock in hand when he entered on the ministry. His title for orders was his fellowship; and he was ordained deacon in December 1729, and priest in the February following, by Bishop Gibson.

Newton. At his first setting out in his office, he was curate at St George's, Hanover-square; and continued for several years assistant preacher to Dr Trebeck. His first preferment was that of reader and afternoon preacher at Grosvenor Chapel, in South Audley street.

This introduced him to the family of Lord Tyrconnel, to whose son he became tutor. He continued in this situation for many years, very much at his ease, and on terms of great intimacy and friendship with Lord and Lady Tyrconnel, "without so much (says he) as an unkind word or a cool look ever intervening."

In the spring of 1744, he was, through the interest of the earl of Bath (who was his great friend and patron, and whose friendship and patronage were returned by grateful acknowledgments and the warmest encomiums), presented to the rectory of St Mary le Bow; so that he was 40 years old before he obtained any living.

At the commencement of 1745, he took his doctor's degree. In the spring of 1747 he was chosen lecturer of St George's, Hanover-square, by a most respectable vestry of noblemen and gentlemen of high distinction. In August following he married his first wife, the eldest daughter of Dr Trebeck; an unaffected, modest, decent young woman, with whom he lived very happy in mutual love and harmony near seven years.

In 1749 he published his edition of Milton's Paradise Lost, which (says he, very modestly) it is hoped hath not been ill received by the public, having, in 1775, gone through eight editions. After the Paradise Lost, it was judged (says he) proper that Dr Newton should also publish the Paradise Regained, and other poems of Milton; but these things he thought detained him from other more material studies, though he had the good fortune to gain by them more than Milton did by all his works put together. But his greatest gain (he says) was their first introducing him to the friendship and intimacy of two such men as Bishop Warburton and Dr Jortin, whose works will speak for them better than any private commendation.

In 1754 he lost his father, at the age of 83; and within a few days his wife, at the age of 38. This was the severest trial he ever underwent, and almost overwhelmed him. At that time he was engaged in writing his Dissertations on the Prophecies; and happy it was for him: for in any affliction he never found a better or more effectual remedy than plunging deep into study, and fixing his thoughts as intensely as he possibly could upon other subjects. The first volume was published the following winter; but the other did not appear till three years afterwards; and as a reward for his past and an incitement to future labours, he was appointed, in the mean time, to preach Boyle's lecture. The bishop informs us, that 1250 copies of the Dissertations were taken at the first impression, and 1000 at every other edition: and "though (says he) some things have been since published upon the same subjects, yet they still hold up their head above water, and having gone through five editions, are again prepared for another. Abroad, too, their reception hath not been unfavourable, if accounts from thence may be depended upon." They were translated into the German and Danish languages; and received the warmest encomiums from persons of learning and rank.

In the spring of 1757, he was made prebendary of Westminster, in the room of Dr Green, and promoted to the deanery of Salisbury. In October following, he he was made sub-almoner to his majesty. This he owed to Bishop Gilbert. He married a second wife in September 1761. She was the widow of the Rev. Mr Hand, and daughter of John Lord Viscount Lisburn. In the same month he kissed his majesty's hand for his bishopric.

In the winter of 1764, Dr Stone, the primate of Ireland, died. Mr Grenville sent for Bishop Newton, and in the most obliging manner desired his acceptance of the primacy. Having maturely weighed the matter in his mind, he declined the offer.

In 1768 he was made dean of St Paul's. His ambition was now fully satisfied; and he firmly resolved never to ask for any thing more.

From this time to his death, ill health was almost his constant companion. It was wonderful that such a poor, weak, and slender thread as the bishop's life, should be spun out to such an amazing length as it really was. In the autumn of 1781 (usually the most favourable part of the year to him) he laboured under repeated illnesses: and on Saturday the 9th of February 1782, he began to find his breath much affected by the frost. His complaints grew worse and worse till the Thursday following. He got up at five o'clock, and was placed in a chair by the fire; complained to his wife how much he had suffered in bed, and repeated to himself that portion of the Psalms, "O my God, I cry unto thee in the day time," &c. &c. About six o'clock he was left by his apothecary in a quiet sleep. Between seven and eight he awoke, and appeared rather more easy, and took a little refreshment. He continued dozing till near nine, when he ordered his servant to come and dress him, and help him down stairs. As soon as he was dressed, he inquired the hour, and bid his servant open the shutter and look at the dial of St Paul's. The servant answered, it was upon the stroke of nine. The bishop made an effort to take out his watch, with an intent to set it; but sunk down in his chair, and expired without a sigh or the least visible emotion, his countenance still retaining the same placid appearance which was so peculiar to him when alive. Of his numerous works, his Dissertations on the Prophecies are by much the most valuable. His learning was undoubtedly very considerable; but he seldom exhibits evidence of a very vigorous mind. On one occasion, indeed, he appears to have thought with freedom; for we believe he was the first dignitary of the church of England who avowed his belief of the final restitution of all things to harmony and happiness.

NEWTYA, a port little known, on the coast between Goa the capital of the Portuguese settlements in India, and the English settlement of Bombay. Mr Rennel conjectures it to be the *Nitrias* of Pliny; near which the pirates cruized for the Roman ship. The same writer places it near to 15° 52′ 30″ North Latitude, and 73° 16′ 30″ East Longitude.

Nexi. NEXI, among the Romans, persons free born, who for debt were reduced to a state of slavery. By the laws of the twelve tables it was ordained, that insolvent debtors should be given up to their creditors to be bound in fetters and cords, whence they were called *Nexi*; and though they did not entirely lose the rights

of

Neytrecht ‖ Ngo-kia. of freemen, yet they were often treated more harſhly than the ſlaves themſelves. If any one was indebted to ſeveral perſons, and could not within ſixty days find a cautioner, his body according to ſome, but according to others his effects, might be cut in pieces, and divided among his creditors. This latter opinion ſeems by much the moſt probable, as Livy mentions a law by which creditors had a right to attach the goods but not the perſons of their debtors.

NEYTRECHT, a town of Upper Hungary, capital of a county of the ſame name, with a biſhop's ſee; ſeated on the river *Neitra*, 40 miles north-eaſt of Preſburg. E. Long. 17. 49. N. Lat. 48. 28.

NGAN-KING-FOU, a city of China, and capital of the weſtern part of the province of Kiang-nan. It is governed by a particular viceroy, who keeps a large garriſon in a fort built on the banks of the river Yang-tſe-kiang. Its ſituation is delightful; its commerce and riches render it very conſiderable; and every thing that goes from the ſouthern part of China to Nan-king muſt paſs through it. All the country belonging to it is level, pleaſant, and fertile. It has under its juriſdiction only ſix cities of the third claſs.

NGO-KIA, a Chineſe drug, of which the compoſition will no doubt appear as ſingular as the numerous properties aſcribed to it. In the province Chang-tong, near Ngo-hien, a city of the third claſs, is a well formed by nature, which is reckoned to be ſeventy feet in depth, and which has a communication, as the Chineſe ſay, with ſome ſubterranean lake, or other large reſervoir. The water drawn from it is exceedingly clear, and much heavier then common; and if it be mixed with muddy water, it purifies it and renders it limpid, by precipitating all its impurities to the bottom of the veſſel. This water is employed in making the ngo-kia, which is nothing elſe but a kind of glue procured from the ſkin of a black aſs.

The animal is killed and flayed, and the ſkin is ſteeped for five days in water drawn from this well. At the end of that time, it is taken out to be ſcraped and cleaned; it is afterwards cut into ſmall pieces, which are boiled over a ſlow fire, in the ſame kind of water, until it is reduced to a jelly, which is ſtrained, while warm, through a cloth, to free it from all the groſs matter which could not be melted. When this glue is cool, and has acquired a conſiſtence, it is formed into ſquare cakes, upon which the Chineſe imprint characters and coats of arms, or the ſigns of their ſhops.

This well is the only one of the kind in China; it is always ſhut, and ſealed by the governor of the place with his own ſeal, until the cuſtomary day of making the emperor's glue. This operation generally laſtsfrom the autumnal harveſt till the month of March. During that time, the neighbouring people and merchants treat for the purchaſe of the glue with thoſe who guard the well, and with the people who make it. The latter manufacture as much of it as they can, on their own account, with this difference, that it is not ſo pure, and that they are leſs ſcrupulous in examining whether the aſs be fat, or of a very black colour; however, all the glue made here is as much eſteemed at Peking as that which the mandarins who are on the ſpot tranſmit to court and to their friends.

As this drug is in the greateſt requeſt, and as the quantity of it made at Ngo-hien is not ſufficient to ſupply the whole empire, there are not wanting people who counterfeit it elſewhere, and who manufacture a ſpurious kind from the ſkins of mules, horſes, and camels, and ſometimes even from old boots; it is, however, very eaſy to diſtinguiſh that which is genuine; it has neither a bad ſmell nor a diſagreeable taſte when applied to the mouth; it is brittle and friable, and always of a deep black colour, ſometimes inclining to red. The qualities of the counterfeit kind are entirely different; both its taſte and ſmell are diſagreeable, and it is viſcous and flabby even when made of the ſkin of a hog, which is that which imitates the true kind the beſt. Niagara.

The Chineſe attribute a great number of virtues to this drug. They aſſure us that it diſſolves phlegm, facilitates the play and elaſticity of the lungs, gives a free reſpiration to thoſe who breathe with difficulty; that it comforts the breaſt, increaſes the blood, ſtops dyſenteries, provokes urine, and ſtrengthens children in the womb. Without warranting the truth of all theſe properties, it appears, at leaſt, certain, by the teſtimony of the miſſionaries, that this drug is ſerviceable in all diſeaſes of the lungs. It is taken with a decoction of ſimples, and ſometimes in powder, but very ſeldom.

NIAGARA, a fort of North America, which was taken from the French in 1759, and ſtill remains in poſſeſſion of the Britiſh government. To the author of the American Geography this ſeems to give great offence; probably becauſe the fort in a manner commands all the interior parts of the continent; is a key to the north-weſtern territories of the United States; and is ſurrounded by the *Six Nations* of Indians, with whom the Engliſh have been long in alliance. It is ſituated on a ſmall peninſula formed by the river Niagara as it flows into the lake Ontario. About ſix leagues from the fort is the greateſt cataract in the world, know by the name of the *Waterfall of Niagara*. The river at this fall runs from SSE to NNW; and the rock of the fall croſſes it not in a right line, but forms a kind of figure like a hollow ſemicircle or horſe ſhoe. Above the fall, in the middle of the river, is an iſland about 800 or 1000 feet long; the lower end of which is juſt at the perpendicular edge of the fall. On both ſides of this iſland runs all the water that comes from the lakes of Canada; viz. Lake Superior, Lake Miſchigan, Lake Huron, and Lake Erie, which have ſome large rivers that open themſelves into them. Before the water comes to this iſland, it runs but ſlowly compared with its motion afterwards, when it grows the moſt rapid in the world, running with a ſurpriſing ſwiftneſs before it comes to the fall. It is perfectly white, and in many places is thrown high up into the air. The water that runs down on the weſt ſide is more rapid, in greater abundance, and whiter, than that on the eaſt ſide; and ſeems almoſt to outfly an arrow in ſwiftneſs. When you are at the fall, and look up the river, you may ſee that the water is everywhere exceedingly ſteep, almoſt like the ſide of an hill; but when you come to look at the fall itſelf, it is impoſſible to expreſs the amazement it occaſions. The height of it, as meaſured by mathematical inſtruments, is found to be exactly 137 feet; and when the water is come to the bottom, it jumps back to a very

Niagara. great height in the air. The noise may be heard at the distance of 45 miles, but seldom further; nor can it be heard even at Fort Niagara, which is only six leagues distant, unless Lake Ontario is calm. At that fort it is observed, that when they hear the noise of the fall more loud than ordinary, they are sure that a north-east wind will follow; which is the more surprising, as the fort lies south-west from the fall. At some times the fall makes a much greater noise than at others; and this is held for an infallible sign of approaching rain or other bad weather.

From the place where the water falls there arises abundance of vapour like very thick smoke, insomuch that when viewed at a distance you would think that the Indians had set the forests on fire. These vapours rise high in the air when it is calm, but are dispersed by the wind when it blows hard. If you go into this vapour or fog, or if the wind blows it on you, it is so penetrating, that in a few moments you will be as wet as if you had been under water. Some are of opinion that when birds come flying into this fog or smoke of the fall, they drop down and perish in the water; either because their wings are become wet, or that the noise of the fall astonishes them, and they know not where to go in the darkness: but others think that seldom or never any bird perishes there in that manner; because among the abundance of birds found dead below the fall, there are no other sorts than such as live and swim frequently in the water; as swans, geese, ducks, water hens, teal, and the like. And very often great flocks of them are seen going to destruction in this manner: they swim in the river above the fall, and so are carried down lower and lower by the water; and as water fowl commonly take great delight in being carried with the stream, they indulge themselves in enjoying this pleasure so long, till the swiftness of the water becomes so great, that it is no longer possible for them to rise, but they are driven down the precipice and perish. They are observed, when they draw nigh the fall, to endeavour with all their might to take wing and leave the water; but they cannot. In the months of September and October such abundant quantities of dead water fowl are found every morning below the fall, on the shore, that the garrison of the fort for a long time live chiefly upon them. Besides the fowl, they find also several sorts of dead fish, also deer, bears, and other animals which have tried to cross the water above the fall: the larger animals are generally found broken to pieces. Just below, a little way from the fall, the water is not rapid, but goes all in circles, and whirls like a boiling pot; which however does not hinder the Indians going upon it in small canoes a-fishing; but a little further, and lower, the other smaller falls begin. When you are above the fall, and look down, your head begins to turn; even such as have been here numberless times, will seldom venture to look down, without at the same time keeping fast hold of some tree with one hand.

It was formerly thought impossible for any body living to come at the island that is in the middle of the fall: but an accident that happened about 50 years ago made it appear otherwise. The history is this: Two Indians of the Six Nations went out from Niagara fort to hunt upon an island that is in the middle of the river, or strait, above the great fall, on which there used to be abundance of deer. They took some French brandy with them from the fort, which they tasted several times as they were going over the carrying place; and when they were in their canoe, they took now and then a dram, and so went along up the strait towards the island where they proposed to hunt; but growing sleepy, they laid themselves down in the canoe, which getting loose drove back with the stream, farther and farther down, till it came nigh that island that is in the middle of the fall. Here one of them, awakened by the noise of the fall, cries out to the other that they were gone: Yet they tried if possible to save life. This island was nighest, and with much working they got on shore there. At first they were glad; but when they had considered every thing, they thought themselves hardly in a better state than if they had gone down the fall, since they had now no other choice, than either to throw themselves down the same, or perish with hunger. But hard necessity put them on invention. At the lower end of the island the rock is perpendicular, and no water is running there. The island has plenty of wood; they went to work then, and made a ladder or shrouds of the bark of the lind tree (which is very tough and strong) so long till they could with it reach the water below; one end of this bark ladder they tied fast to a great tree that grew at the side of the rock above the fall, and let the other end down to the water. So they went down along their new invented stairs, and when they came to the bottom in the middle of the fall they rested a little; and as the water next below the fall is not rapid, as before mentioned, they threw themselves out into it, thinking to swim on shore. We have said before, that one part of the fall is on one side of the island, the other on the other side. Hence it is, that the waters of the two cataracts running against each other, turn back against the rock that is just under the island. Therefore, hardly had the Indians begun to swim, before the waves of the eddy threw them back with violence against the rock from whence they came. They tried it several times, but at last grew weary; and by being often thrown against the rock they were much bruised, and the skin torn off their bodies in many places. So they were obliged to climb up stairs again to the island, not knowing what to do. After some time they perceived Indians on the shore, to whom they cried out. These saw and pitied them, but gave them little hope or help: yet they made haste down to the fort, and told the commandant where two of their brothers were. He persuaded them to try all possible means of relieving the two poor Indians; and it was done in the following manner:

The water that runs on the east side of this island is shallow, especially a little above the island towards the eastern shore. The commandant caused poles to be made and pointed with iron; two Indians took upon them to walk to this island by the help of these poles, to save the other poor creatures, or perish themselves. They took leave of all their friends, as if they were going to death. Each had two such poles in his hands, to set to the bottom of the stream, to keep them steady; and in this manner reached the island: and having given poles to the two poor Indians there, they

all

all returned safely to the main land. These two Indians (who in the abovementioned manner were first brought to this island) were nine days on the island, and almost ready to starve to death. Now since the road to this island has been found, the Indians go there often to kill deer, which have tried to cross the river above the fall, and are driven upon it by the stream. On the west side of this island are some small islands or rocks, of no consequence. The east side of the river is almost perpendicular, the west side more sloping. In former times, a part of the rock at the fall which is on the west side of the island, hung over in such a manner, that the water which fell perpendicularly from it left a vacancy below, so that people could go under between the rock and the water; but the prominent part some years since broke off and fell down. The breadth of the fall, as it runs in a semicircle, is reckoned to be about 300 feet. The island is in the middle of the fall, and from it the water on each side is almost the same breadth; the breadth of the island at its lower end is about 100 feet. Below the fall, in the holes of the rocks, are great plenty of eels, which the Indians and French catch with their hands without any other means. Every day when the sun shines, you see here from ten o'clock in the morning to two in the afternoon, below the fall, and under you, where you stand at the side of the fall, a glorious rainbow, and sometimes two, one within the other. The more vapours, the brighter and clearer is the rainbow. When the wind carries the vapours from that place, the rainbow is gone, but appears again as soon as new vapours come. From the fall to the landing above it, where the canoes from Lake Erie put ashore (or from the fall to the upper end of the carrying place), is half a mile. Lower the canoes dare not come, lest they should be obliged to try the fate of the two Indians, and perhaps with less success. They have often found below the fall pieces of human bodies, perhaps drunken Indians, that have unhappily come down to the fall. The French say, that they have often thrown whole great trees into the water above, to see them tumble down the fall: they went down with surprising swiftness, but could never be seen afterwards; whence it was thought there was a bottomless deep or abyss just under the fall. The rock of the fall consists of a gray limestone.

Having mentioned the *Six Nations* which live on the banks of the Niagara, we shall here, in addition to what we have said elsewhere (see AMERICA, N° 17.) subjoin a few particulars relative to those nations which, as they seem not to be well understood even in America, are probably still less known in Europe. The information which we have to give was communicated to the Royal Society of London by Mr Richard M'Causland surgeon to the 8th regiment of foot, who, writing from the best authority, informs us, that each nation is divided into three tribes, of which the principal are called the *turtle tribe*, the *wolf tribe*, and the *bear tribe*.

Each tribe has two, three, or more chiefs, called *sachems*; and this distinction is always hereditary in the family, but descends along the female line: for instance, if a chief dies, one of his sister's sons, or one of his own brothers, will be appointed to succeed him. Among these no preference is given to proximity or primogeniture; but the sachem, during his lifetime, pitches upon one whom he supposes to have more abilities than the rest; and in this choice he frequently, though not always, consults the principal men of the tribe. If the successor happens to be a child, the offices of the post are performed by some of his friends until he is of sufficient age to act himself.

Each of these posts of sachem has a name which is peculiar to it, and which never changes, as it is always adopted by the successor: nor does the order of precedency of each of these names or titles ever vary. Nevertheless, any sachem, by abilities and activity, may acquire greater power and influence in the nation than those who rank before him in point of precedency; but this is merely temporary, and dies with him.

Each tribe has one or two chief warriors; which dignity is also hereditary, and has a peculiar name attached to it.

These are the only titles of distinction which are fixed and permanent in the nation; for although any Indian may by superior talents, either as a counsellor or as a warrior, acquire influence in the nation, yet it is not in his power to transmit this to his family.

The Indians have also their great women as well as their great men, to whose opinions they pay great deference; and this distinction is also hereditary in families. They do not sit in council with the sachems, but have separate ones of their own.—When war is declared, the sachems and great women generally give up the management of public affairs into the hands of the warriors. It may however so happen, that a sachem may at the same time be also a chief warrior.

Friendships seem to have been instituted with a view towards strengthening the union between the several nations of the confederacy; and hence friends are called the *sinews of the Six Nations*. An Indian has therefore generally one or more friends in each nation. Besides the attachment which subsists during the lifetime of the two friends, whenever one of them happens to be killed, it is incumbent on the survivor to replace him, by presenting to his family either a scalp, a prisoner, or a belt consisting of some thousands of wampum; and this ceremony is performed by every friend of the deceased.

The purpose and foundation of war parties, therefore, is in general to procure a prisoner or scalp to replace the friend or relation of the Indian who is the head of the party. An Indian who wishes to replace a friend or relation presents a belt to his acquaintance; and as many as choose to follow him accept this belt, and become his party. After this, it is of no consequence whether he goes on the expedition or remains at home (as it often happens that he is a child;) he is still considered as the head of the party. The belt he presented to his party is returned fixed to the scalp or prisoner, and passes along with them to the friends of the person he replaces. Hence it happens, that a war party, returning with more scalps or prisoners than the original intention of the party required, will often give one of these supernumerary scalps or prisoners to another war party wh[illegible]

meet going out; upon which this party, having fulfilled the purpose of their expedition, will sometimes return without going to war.

NICÆA, (anc. geog.), the metropolis of Bithynia; situated on the lake Ascanius, in a large and fertile plain; in compass 16 stadia: first built by Antigonus, the son of Philip, and thence called *Antigonea*; afterwards completed by Lysimachus, who called it *Nicæa*, after his consort the daughter of Antipater. According to Stephanus, it was originally a colony of the Bottiæi, a people of Thrace, and called *Ancore*; and afterwards called *Nicæa*. Now *Nice* in Asia the Less*. Famous for the first general council.—A second *Nicæa*, (Diodorus Siculus), of Corsica.—A third, of the Hither India, (Arrian); situted on the west side of the Hydaspes, opposite to Buciphale, on the east side.—A fourth *Nicæa*, a town of Liguria, at the Maritime Alps, on the east side of the river Paulon near its mouth, which runs between the Varus and Nicæa, (Mela). A colony of the Massilians, (Stephanus); the last town of Italy to the west. Now *Nizza* or *Nice*, capital of the county of that name, on the Mediterranean.—A fifth, of Locris, (Strabo); a town near Thermopylæ; one of the keys of that pass. It stood on the Sinus Maliacus.

* See *Nice*.

NICAISE (Claude), a celebrated antiquary in the 17th century, was descended of a good family at Dijon, where his brother was proctor-general of the chamber of accounts. Being inclined to the church, he became an ecclesiastic, and was made a canon in the holy chapel at Dijon; but devoted himself wholly to the study and knowledge of antique monuments. Having laid a proper foundation of learning at home, he resigned his canonry, and went to Rome, where he resided many years; and after his return to France, he held a correspondence with almost all the learned men in Europe. Perhaps there never was a man of letters who had so frequent and extensive a commerce with the learned men of his time as the Abbé Nicaise. This correspondence took up a great part of his time, and hindered him from enriching the public with any large works; but the letters which he wrote himself, and those which he received from others, would made a fine and curious *Commercium Epistolicum*. He published a Latin dissertation *De Nummo Pantheo*; An Explication of an Antique Monument found at Guienne, in the diocese of Aach; and A Discourse upon the Form and Figure of the Syrens, which made a great noise. In this tract, following the opinion of Huet bishop of Avranches, he undertook to prove, that they were in reality birds, and not fishes or sea monsters. He translated into French, from the Italian, a piece of Bellori, containing a description of the pictures in the Vatican, to which he added, A Dissertation upon the Schools of Athens and Parnassus, two of Raphael's pictures. He wrote also a small tract upon the ancient music; and died while he was labouring to present the public with the explanation of that antique inscription, *Minervæ Arpatiæ*, which was found in the village of Velley, where he died in October 1701, aged 78.

NICANDER of Colophon, a celebrated grammarian, poet, and physician, who lived about the 160th Olympiad, 140 years before Christ, in the reign of Attalus king of Pergamus, who overcame the Gallo-Greeks. He lived many years in Etolia, of which country he wrote a history. He wrote also many other works, of which only two are now remaining. The one is entitled *Theriaca*, describing in verse the accidents attending wounds made by venomous beasts, with the proper remedies; the other bearing the title of *Alexipharmaca*, wherein he treats poetically of poisons and their antidotes. This Nicander is not to be confounded with Nicander of Thyatira.



NICANDRA, in botany: A genus of the monogynia order, belonging to the decandria class of plants: and in the natural method ranking under the 30th order, *Contortæ*. The calyx is monophyllous and quadripartite: the corolla is monopetalous, tubulated, and parted into 10 *laciniæ*: the fruit is an oval berry, which is grooved longitudinally, and contains many small angular seeds. Of this there is only one species, the *amara*, a native of Guiana. The leaves and stalks are bitter, and used by the natives as an emetic and purge.

NICARAGUA, a large river of South America, in a province of the same name, whose western extremity lies within five miles of the South sea. It is full of dreadful cataracts, and falls at length into the North sea.

Nicaragua, a maritime province of South America, in Mexico, bounded on the north by Honduras, on the east by the North sea, on the south-east by Costa Rica, and on the south-west by the South sea; being 400 miles in length from east to west, and 120 in breadth from north to south. It is one of the most fruitful and agreeable provinces in Mexico, and is well watered with lakes and rivers. The air is wholesome and temperate; and the country produces plenty of sugar, cochineal, and fine chocolate. One of the lakes is 200 miles in circumference, has an island in the middle, and, as some say, has a tide. Leon de Nicaragua is the capital town.

NICARIA, an island of the Archipelago, between Samos and Tine, about 50 miles in circumference. A chain of high mountains runs through the middle, covered with wood, and supplies the country with springs. The inhabitants are very poor, and of the Greek communion; however, they have a little wheat, and a good deal of barley, figs, honey, and wax.

NICASTRO, an episcopal town of Italy, in the kingdom of Naples, and in the Farther Calabria; 16 miles south of Cosenza. E. Long. 15. 59. N. Lat. 39. 15.

NICE, an ancient, handsome, and considerable town on the confines of France and Italy, and capital of a county of the same name, with a strong citadel, a bishop's see, and a senate, which is a kind of a democracy. It has been several times taken by the French, and last of all in 1744, but restored after the treaty of Aix-la-Chapelle. It is very agreeably situated, four miles from the mouth of the river Var, 83 miles S. by W. of Turin, and 83 east of Aix. E. Long. 6. 22. N. Lat. 43. 42.

Nice, a county and province in the dominions of the duke of Savoy. The inhabitants supply Genoa with a great deal of timber for building ships; and carry on a great trade in linen cloth, paper, oil, wine, and honey.—"Although the county of Nice be on

Nice. *Historical and Picturesque description of the County of Nice.*

this side of the mountains, geographers have always considered it as a province of Italy, since they have given to this beautiful part of Italy the river Var for a western limit, which is also the boundary of the county, and flows into the sea at a league distance from the capital. This province is partly covered by the maritime Alps; and is bordered on the east by Piedmont, and the states of Genoa; on the south by the Mediterranean; on the west by the Var; and on the north by Dauphiny. Its length is about 20 leagues of the country, which make about 36 English miles; its breadth is 10 leagues; and its population is about 120,000 souls.

"The city of Nice is the capital, and the seat of the senate, the bishopric, and government. It has become, within these few years, a delightful abode, by the number of strangers who assemble there in the winter, either to re-establish their health, or to enjoy the mildness of the climate, and the beauty of the country, where an unceasing verdure presents eternal spring.

"The town is situated on the sea shore, and is backed by a rock entirely insulated, on which was formerly a castle, much esteemed for its position; but it was destroyed in the year 1706 by Marechal Berwick, the garrison being too thin to defend the extent of the works. There is a distinction between the old and the new town; this last is regular, the houses are well built, and the streets are wide. Its position is by the side of the sea, and it is terminated, on one side, by a charming terrace, which serves for a promenade.

"Any person may live peaceably in this province, without fear of being troubled on points of faith, provided he conducts himself with decorum. The town has three suburbs. 1st, That of St John, which conducts to Cimier, about three leagues north from Nice, &c. The promenades this way are very delightful, and may be enjoyed in a carriage. 2d, That of the Poudriere. 3d, That of the *Croix de Marbre*, or Marble Cross. This suburb is new; and the English almost all lodge in it, being very near the town. The houses are commodious, facing on one side the great road which leads to France, and on the other a fine garden, with a prospect of the sea. All the houses are separate from each other: the company hire them for the season, *i. e.* from October till May. Apartments may be had from 15 to 250 louis. The proprietors commonly furnish linen, plate, &c. There are also in the town very large and commodious houses; as well as the new road, which is opened from the town to the port, by cutting that part of the rock which inclined toward the sea. The situation is delightful, and warmest in winter, being entirely covered from the north wind, and quite open to the south.

"The company is brilliant at Nice, and the amusements of the Carnival are, in proportion to the size of the town, as lively as in any of the great ones in France. There is always an Italian opera, a concert and masked ball, alternately; and the company play rather high.

"It is impossible to find a happier climate than Nice, both for summer and winter. Reaumur's thermometer, in 1781, never fell more than three degrees below the freezing point, and that only for two days; while at Geneva it fell ten: and in the course of the winter of 1785 it fell only two degrees; while at Geneva it fell 15. The month of May is rarely so fine in France as February at Nice. The summer is not so hot as might be expected. The thermometer never rises more than 24 degrees above temperate in the shade; and there is always an agreeable sea breeze from ten in the morning till sunset, when the land breeze comes on. There are three chains of graduated mountains, the last of which confound their summits with the Alps; and to this triple rampart is owing the mild temperature so sensibly different from that of the neighbouring parts.

"The cultivation of the ground is as rich as can be desired. There are alternately rows of corn and beans, separated by vines attached to different fruit-trees, the almond and the fig; so that the earth being incessantly cultivated, and covered with trees, olive, orange, cedar, pomegranate, laurel, and myrtle, causes the constant appearance of spring, and forms a fine contrast with the summits of the Alps, in the back ground, covered with snow."

Nice, Nicephorus.

NICE, an ancient town of Asia, in Natolia, now called *Isnic*, with a Greek archbishop's see. It is famous for the general council assembled here in 325, which endeavoured to suppress the doctrines of Arius. It was formerly a large, populous, and well built place, and even now is not inconsiderable. See ISNIC.

*NICENE Creed*, was composed and established, as a proper summary of the Christian faith, by the council at Nice in 325, against the Arians.—It is also called the *Constantinopolitan creed*, because it was confirmed, with some few alterations, by the council of Constantinople in 381. See CREED.

NICEPHORUS (Gregoras), a Greek historian, was born about the close of the 13th century, and flourished in the 14th, under the emperors Andronicus, John Palæologus, and John Cantacuzenus. He was a great favourite of the elder Andronicus, who made him librarian of the church of Constantinople, and sent him ambassador to the prince of Servia. He accompanied this emperor in his misfortunes, and assisted at his death; after which he repaired to the court of the younger Andronicus, where he seems to have been well received; and it is certain that, by his influence over the Greeks, that church was prevailed on to refuse entering into any conference with the legates of Pope John XXII. But in the dispute which arose between Barlaam and Palamos, taking the part of the former, he maintained it zealously in the council that was held at Constantinople in 1351; for which he was cast into prison, and continued there till the return of John Palæologus, who released him; after which he held a disputation with Palamos, in the presence of that emperor. He compiled a history, which in 11 books contains all that passed from 1204, when Constantinople was taken by the French, to the death of Andronicus Palæologus the younger, in 1341.—The best edition of this work is that of the Louvre, in Greek and Latin, in 1702.

NICEPHORUS (Calistus), a Greek historian, who flourished in the 14th century under the emperor Andronicus Palæologus the elder, wrote an ecclesiastical history in 23 books; 18 of which are still extant, containing the transactions of the church from the birth of Christ

Nicephorus, Niceron. Christ to the death of the emperor Phocas in 610.—We have nothing else but the arguments of the other five books, from the commencement of the reign of the emperor Heraclius, to the end of that of Leo the philosopher, who died in the year 911. Nicephorus dedicated his history to Andronicus Palæologus the elder. It was translated into Latin by John Langius; and has gone through several editions, the best of which is that of Paris, in 1630.

Nicephorus (Blemmidas), a priest and monk of Mount Athos, flourished in the 13th century. He refused the patriarchate of Constantinople, being favourable to the Latin church, and more inclined to peace than any of the Greeks of his time. In this spirit he composed two treatises concerning *The Procession of the Holy Ghost*: one addressed to James patriarch of Bulgaria, and the other to the emperor Theodore Lascaris. In both these he refutes those who maintain, that one cannot say the Holy Ghost proceeds from the Father and the Son. These two tracts are printed in Greek and Latin by Allatius, who has also given us a letter written by Blemmidas on his expelling from the church of her convent Marchesinos, mistress of the emperor John Ducas. There are several other pieces of our author in the Vatican library.

NICERON (John Francis), was born at Paris in 1613. Having finished his academical studies, with a success which raised the greatest hopes of him, he entered into the order of the Minims, and took the habit in 1632; whereupon, as is usual, he changed the name given him at his baptism for that of Francis, the name of his paternal uncle, who was also a Minim, or Franciscan. The inclination and taste which he had for mathematics appeared early. He began to apply himself to that science in his philosophical studies, and devoted thereto all the time he could spare from his other employments, after he had completed his studies in theology. All the branches of the mathematics, however, did not equally engage his attention; he confined himself particularly to optics, and only learned of the rest as much as was necessary for rendering him perfect in this. There remain still, in several houses wherein he dwelt, especially at Paris, some excellent performances, which discover his skill in this way, and which make us regret that a longer life did not suffer him to carry it to that perfection which he desired; since one cannot help being surprised that he proceeded so far as he did, in the midst of those occupations and travels by which he was forced from it, during the short space of time which he lived. He hath himself observed, in the preface to his *Thaumaturgus Opticus*, that he went twice to Rome; and that, on his return home, he was appointed teacher of theology. He was afterwards chosen to accompany Father Francis de la Noue, vicar general of the order, in his visitation of the convents throughout all France. But the eagerness of his passion for study put him upon making the best of all the moments he had to spare for books; and that wise economy furnished him with as much as satisfied him. Being taken sick at Aix in Provence, he died there Sept. 22. 1646, aged 33. He was an intimate acquaintance of Des Cartes. A list of his writings is inserted below (A).

Niceron. Niceron (John Peter), so much celebrated on account of his *Memoirs of Men illustrious in the Republic of Letters*, was born at Paris, March 11. 1685. He was of an ancient and noble family, who were in very high repute about 1540. He studied with success in the Mazarine college at Paris, and afterwards at the college Du Plessis. In a short time, resolving to forsake the world, he consulted one of his uncles, who belonged to the order of Bernabite Jesuits. This uncle examined him; and, not diffident of his election, introduced him as a probationer to that society at Paris.—He was received there in 1702, took the habit in 1703, and made his vows in 1704, at the age of 19.

After he had professed himself, he was sent to Montarges, to go through a course of philosophy and theology; thence he went to Loches in Touraine to teach those sciences. He received the priesthood at Poitiers in 1708. As he was not arrived at the age to assume this order, a dispensation, which his uncommon piety had merited, was obtained in his favour. The college of Montarges having recalled him, he was their professor of rhetoric two years, and of philosophy four.—In spite of all these avocations, he was humanely attentive to every call and work of charity, and to the instruction of his fellow creatures, many of whom heard him deliver out fit rules of conduct for them, not only from the pulpits of most of the churches within the province, but even from those of Paris.—In 1716, his superiors invited him to that city, that he might have an opportunity of following, with the more convenience, those studies for which he always had expressed the greatest inclination. He not only understood the ancient but the modern languages; a circumstance of infinite advantage in the composition of those works which he has given to the public, and which he carried on with great assiduity to the time of his death, which happened, after a short illness, July 8. 1738, at the age of 53. His works are, 1. *Le grand Febrifuge*; or, a Dissertation to prove that common water is the best remedy in fevers, and even in the plague, translated from the English of John Hancock minister of St Margaret's, London; in 12mo. This little treatise made its appearance, amongst other pieces relating to this subject, in 1720; and was attended with a success which carried it through three editions; the last came out in 1730, in 2 vols. 12mo, entitled, *A Treatise on Common Water*; Paris, printed by Cavelier. 2. *The Voyages of John Ouvington to Surat, and divers parts of Asia and Africa*, containing the history of the revolution in the kingdom of Golconda, and some observations upon silk worms; Paris, 1725, 2 vols. 12mo. 3. *The Conversion of England to Christianity, compared with its pretended Reformation*, a work translated from the

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(A) These are, 1. *L'Interpretation des chiffres, ou regles pour bien entendre et expliquer facilement toutes sortes des chiffres simples*, &c. 2. *La perspective curieuse, ou magie artificielle des effets merveilleux de l'optique, catoprique, et dioptrique.* This is only an essay to the following work: 3. *Thaumaturgus opticus; sive, Admiranda optices, catoptrices, et dioptrices, pars prima*, &c. He intended to add two other parts, but was prevented by death.

the English; Paris 1729, 8vo. 4. *The Natural History of the Earth*, translated from the English of Mr Woodward, by Monf. Nogues, doctor in physic; with an answer to the objections of Dr Carmerarius; containing also several letters written on the same subject, and a methodical distribution of fossils, translated from the English by Niceron; Paris 1735, 4to. 5. *Memoirs of Men illustrious in the Republic of Letters*, with a critical account of their works; Paris, 12mo. The first volume of this great work appeared in 1727; the others were given to the public in succession, as far as the 39th, which appeared in 1738. The 40th volume was published after the death of the author, in 1739.

NICETAS (David), a Greek historian, a native, as some relate, of Paphlagonia, who lived about the end of the 9th century. He wrote *The Life of St Ignatius*, patriarch of Constantinople, which was translated into Latin by Frederic Mutius, bishop of Termoli: he composed also several panegyrics in honour of the apostles and other saints, which are inserted in the last continuation of the *Bibliotheca Patrum* by Combesis.

NICETAS (surnamed SERRON), deacon of the church of Constantinople, cotemporary with Theophylact in the 11th century, and afterwards bishop of Heraclea, wrote a *Catena upon the book of Job*, compiled from passages of several of the fathers, which was printed at London in folio, 1637. We have also, by the same writer, several *catenæ* upon the Psalms and Canticles, Basil 1552; together with a Commentary on the poems of Gregory Nazianzen.

NICETAS (Arhominates), a Greek historian of the 13th century, called *Coniates*, as being born at Chone, or Colossus, in Phrygia. He was employed in several considerable affairs at the court of Constantinople; and when that city was taken by the French in 1204, he withdrew, with a young girl taken from the enemy, to Nice in Bithynia, where he married his captive, and died in 1206. He wrote a History, or Annals, from the death of Alexius Comnenus in the year 1118, to that of Badouin in 1205; of which work we have a Latin translation by Jerome Wolfius, printed at Basil in 1557; and it has been inserted in the body of the Byzantine Historians, printed in France at the Louvre.

NICHE, in architecture, a hollow sunk into a wall, for the commodious and agreeable placing of a statue. The word comes from the Italian *nechia*, "sea-shell;" in regard the statue is here enclosed in a shell, or perhaps on account of the shell wherewith the tops of some of them are adorned.

NICHOLS (William), son of John Nichols of Donington, in Bucks, was born in 1664. At what school he was educated we have not been informed; but in 1679 he became a commoner of Magdalene Hall, Oxford, whence he afterwards removed to Wadham College, and took the degree of bachelor of arts, Nov. 27. 1683.—In October 1684, he was admitted probationer fellow of Merton College. At the commencement of 1688, he took his master's degree; and about the same time being admitted into orders, he became chaplain to Ralph earl of Montague, and was in September 1791 preferred to the rectory of Selsey, near Chichester, in Sussex. He was admitted B. D. July 2. 1692; and D. D. Nov. 29. 1695. Though his time was wholly devoted to piety and study, and though he published, in Latin and in English, no fewer than 19 works in defence of Christianity, and the doctrines and worship of the church of England, he was so totally overlooked, even by those who professed to be patrons of orthodoxy, that towards the close of his life we find him complaining to Robert earl of Oxford, that he was forced on the drudgery of being editor of Mr Selden's books for a little money to buy other books, to enable him to carry on his liturgical labours. He died in the beginning of the year 1712. Of his numerous publications, those which are most generally known are, *A Conference with a Theist*, in five parts, and *A Comment on the Book of Common Prayer and Administration of the Sacraments*, &c. A volume of letters in Latin between him and Joblonski, Ostervald, and Wetstein, &c. was presented, October 28. 1712, by his widow to the archbishop of Canterbury; and they are now preserved among the valuable MSS. at Lambeth, N° 676.



NICHOLLS (Dr Frank), was born in London in the year 1699. His father was a barrister at law; and both his parents were of good families in Cornwall. After receiving the first rudiments of his education at a private school in the country, where his docility and sweetness of temper endeared him equally to his master and his school fellows, Frank was in a few years removed to Westminster, and from thence to Oxford, where he was admitted a commoner (or sojourner) of Exeter college, under the tuition of Mr John Haviland, on March 4. 1714. There he applied himself diligently to all the usual academical studies, but particularly to natural philosophy and polite literature, of which the fruits were most conspicuous in his subsequent lectures on physiology. After reading a few books on anatomy, in order to perfect himself in the nomenclature of the animal parts then adopted, he engaged in dissections, and then devoted himself to the study of nature, perfectly free and unbiassed by the opinions of others.

On his being chosen reader of anatomy in that university, he employed his utmost attention to elevate, and illustrate a science which had there been long depressed and neglected; and by quitting the beaten track of former lecturers, and minutely investigating the texture of every bowel, the nature and order of every vessel, &c. he gained a high and a just reputation. He did not then reside at Oxford; but, when he had finished his lectures, used to repair to London, the place of his abode, where he had determined to settle. He had once an intention of fixing in Cornwall, and for a short time practised there with great reputation; but being soon tired of the fatigues attendant on that profession in the country, he returned to London, bringing back with him a great insight, acquired by diligent observation, into the nature of the miliary fever, which was attended with the most salutary effects in his subsequent practice at London.

About this time he resolved to visit the continent, partly with a view of acquiring the knowledge of men, manners, and languages; but chiefly to acquaint himself with the opinions of foreign naturalists on his favourite study. At Paris, by conversing freely with the learned, he soon recommended himself to their notice and esteem. Winslow's was the only good system of physiology at that time known in France, and Morgagni's

Nicholls.

gagni's and Santorini's of Venice in Italy, which Dr Nicholls likewise soon after visited. On his return to England, he repeated his physiological lectures in London, which were much frequented, not only by students from both the universities, but also by many surgeons, apothecaries, and others. Soon after, his new and successful treatment of the miliary fever, then very prevalent in the southern parts of England, added much to his reputation. In 1725, at a meeting of the Royal Society, he gave his opinion on the nature of *aneurisms*, in which he dissented from Dr Freind in his History of Physic.

At the beginning of the year 1728, he was chosen a fellow of the Royal Society, to which he afterwards communicated the description of an uncommon disorder (published in the Transactions), viz. a polypus, resembling a branch of the pulmonary vein (for which Tulpius has strangely mistaken it), coughed up by an asthmatic person. He also made observations (in the same volume of the Transactions) on a treatise, by M. Helvetius of Paris, on the Lungs. Towards the end of the year 1729, he took the degree of doctor of physic at Oxford. At his return to London, he underwent an examination by the president and censors of the College of Physicians, previous to his being admitted a candidate, which every practitioner must be a year before he can apply to be chosen a fellow. Dr. Nicholls was chosen into the college on June 26. 1732; and two years after, being chosen Gulstonian reader of Pathology, he made the structure of the heart, and the circulation of the blood, the subject of his lectures. In 1736, at the request of the president, he again read the Gulstonian lecture; taking for his subject those parts of the human body which serve for the secretion and discharge of the urine; and the causes, symptoms, and cure, of the diseases occasioned by the stone. In 1739, he delivered the anniversary Harveian oration. In 1743, he married Elizabeth, youngest daughter of the celebrated Dr Mead, by whom he had five children, two of whom died young. Two sons and a daughter survived him. In 1748, Dr Nicholls undertook the office of chirurgical lecturer, beginning with a learned and elegant dissertation on the *Anima Medica*. About this time, on the death of Dr John Cuningham, one of the elects of the college, Dr Abraham Hall was chosen to succeed him, in preference to our author, who was his senior, without any apparent reason. With a just resentment, he immediately resigned the office of chirurgical lecturer, and never after attended the meetings of the fellows, except when business of the utmost importance was in agitation.

In 1751, he took some revenge in an anonymous pamphlet, entitled "The petition of the Unborn Babes to the Censors of the Royal College of Physicians of London;" in which Dr Nesbit (*Pocus*), Dr Maule (*Maulus*), Dr Barrowby (*Barebone*), principally, and Sir William Brown, Sir Edward Hulse, and the Scots incidentally, are the objects of his satire.

In 1753, on the death of Sir Hans Sloane, Bart in his 94th year, Dr Nicholls was appointed to succeed him as one of the king's physicians, and held that office till the death of his royal master in 1760, when this most skilful physician was superseded with something like the offer of a pension, which he rejected with disdain.

Nicholls. Nickel.

The causes, &c. of the uncommon disorder of which the late king died, viz. a rupture of the right ventricle of the heart, our author explained in a letter to the earl of Macclesfield, president of the Royal Society, which was published in the Philosophical Transactions Vol. L.

In 1772, to a second edition of his treatise *De Anima Medica*, he added a dissertation *De motu cordis et sanguinis in homine nato et non nato*, inscribed to his learned friend and coadjutor the late Dr Lawrence.

Tired at length of London, and also desirous of superintending the education of his son, he removed to Oxford, where he had spent most agreeably some years in his youth. But when the study of the law recalled Mr Nicholls to London, he took a house at Epsom, where he passed the remainder of his life in a literary retirement, not inattentive to natural philosophy, especially the cultivation of grain, and the improvement of barren soils, and contemplating also with admiration the internal nature of plants, as taught by Linnæus.

His constitution never was robust. In his youth, at Oxford, he was with difficulty recovered from a dangerous fever by the skill of Doctors Frampton and Frewen; and afterwards at London he had frequently been afflicted with a catarrh, and an inveterate asthmatic cough, which, returning with great violence at the beginning of the year 1778, deprived the world of this valuable man on January 7th, in the 80th year of his age.

Dr Lawrence, formerly president of the college of physicians, who gratefully ascribed all his physiological and medical knowledge to his precepts, and who, while he lived, loved him as a brother, and revered him as a parent, two years after printed, and gave to his friends, a few copies of an elegant Latin Life of Dr Nicholls (with his head prefixed, a striking likeness, engraved by Hall from a model of Gosset, 1779); from which, through the medium of the Gentleman's Magazine, the above particulars are chiefly extracted.

NICIAS, a celebrated painter of Athens, flourished about 322 years before the Christian era; and was universally extolled for the great variety and noble choice of his subjects, the force and relievo of his figures, his skill in the distribution of the lights and shadows, and his dexterity in representing all sorts of four-footed animals, beyond any master of his time. His most celebrated piece was that of Tartarus or Hell, as it is described by Homer, for which King Ptolemy the son of Lagus offered him 60 talents, or 11,250l. which he refused, and generously presented it to his own country. He was much esteemed likewise by all his cotemporaries for his excellent talent in sculpture.

NICKEL, in chemistry and mineralogy, a substance classed among the semimetals, though several eminent chemists are of opinion that it is a compound; and Mr Bergman, who has made more experiments upon it than any other person, conjectures that it is a modification of iron.

It was first obtained from an ore called *kupfer-nickel*, sometimes

Nickel. ſometimes gray coloured, but often of a reddiſh-yellow; though ſeveral others are now diſcovered. "It had its name (ſays Mr Bergman), and probably ſtill retains it, from this circumſtance, that though it has the appearance of containing copper, not the ſmalleſt particle of that metal can be extracted from it, even by fire." It was firſt mentioned by V. Hiema, in 1694, in a book written in the Swediſh language, concerning the diſcovery of ores and other mineral ſubſtances. It is ſuppoſed by Henckel to be a ſpecies of cobalt, or arſenic alloyed with copper. Cramer claſſes it with the arſenical or cupreous ores; though both they, and all other chemiſts, confeſs that they were never able to extract one particle of copper from it. Mr Cronſtedt, in the years 1751 and 1754, ſhowed by many accurate experiments that it contained a new ſemimetal, or at leaſt that a regulus different from all others was obtainable from its ore. This ore, called *kupfer-nickel*, or falſe copper, as has already been obſerved, is of a coppery lead colour, and almoſt always covered with a greeniſh gray effloreſcence. "It is (ſays Mr Fourcroy) *very common* at Freyberg in Saxony, where it is often mixed with the gray ore of cobalt; but it is diſtinguiſhed from it by its red colour." Mr Bergman, however, complains greatly of the *ſcarcity* of this mineral, ſo that he could hardly procure a quantity ſufficient to make experiments upon. Fourcroy alſo tells us, that "Mr Sage, having treated this ore with ſal-ammoniac, obtained iron, copper, and cobalt, and thinks that it is compoſed of theſe three metallic matters, together with arſenic. It likewiſe contains a ſmall proportion of gold, according to this chemiſt. It is proper to obſerve, that theſe reſults do not agree with thoſe of Mr Bergman; he is ſaid to have operated on the *kupfer-nickel* of Biber, in Heſſe, and of Alemont in Dauphiny. Mr Bergman himſelf, however, informs us, that he undertook his experiments expreſsly with a view to diſcover whether the theory of Mr Sage was juſt; and that he operated moſtly on ſome regulus made by Mr Cronſtedt, and found in the Suabian collection.

"Cronſtedt (ſays Mr Fourcroy) aſſures us, that the metallic matter, called *ſpeiſs* by the Germans, which is collected in the crucibles uſed in the melting of ſmalt, affords nickel. Mr Monnet thinks, that the ſpeiſs of the manufacture of Gengenback, 14 leagues from Straſburg, is true nickel: and as the ore of cobalt made uſe of in that place to make ſmalt is very pure, he concludes, that nickel is neceſſarily a product of cobalt, itſelf. But Mr Beaumé has obtained nickel from almoſt all the ores of cobalt by means of ſulphur; it therefore ſeems, that the ore of cobalt, which is wrought at Gengenback, contains nickel not diſtinguiſhable by the eye, on account of the intimate union of theſe two metallic matters."

"To obtain the regulus of nickel (ſays Mr Bergman, the ore muſt be firſt ſubjected to roaſting; during which a quantity of ſulphur and arſenic, greater or leſs according to the nature of the ore, is expelled; ſo that it ſometimes loſes above half its weight, but frequently not above 0.3. This ore, though long and completely calcined, does not always acquire the ſame colour, but in general becomes greener in proportion as it is more rich. Sometimes (eſpecially if ſuffered to lie at reſt) its upper ſurface is covered with green vegetations, ſomewhat of the form of coral, which are hard and ſonorous. A double or a triple quantity of black flux is to be added to the roaſted powder, and the mixture well fuſed in a forge in an open crucible covered with common ſalt, in the uſual method. The veſſel being broken, a metallic globule is found at the bottom, the weight of which amounts to 0.1, 0.2, or at the moſt to 0.5 of the crude ore. The regulus thus obtained, however, is far from being pure; for although the roaſting be ever ſo violent and long continued, yet a conſiderable quantity of ſulphur, but eſpecially arſenic, ſtill remains concealed, excluſive of cobalt, and a great proportion of iron; which laſt is ſo generally prevalent as to make the regulus magnetic: and this variety of heterogeneous matter is the cauſe why the regulus varies much, not only in reſpect to its fracture, the poliſhed ſurface of which is either ſmooth or lamellated, but alſo in regard to its white colour, which is more or leſs yellow or red.

He has not been able to determine the properties of nickel when perfectly pure, as the continual preſence of iron in ſome reſpect obſcures them: From the calculations which he makes, however, Mr Bergman concludes that the ſpecific gravity of nickel is not leſs than 9.000 at the leaſt. If a ſmall portion of gold enter the compoſition, the greatneſs of the weight might thence be explained; but though this metal is almoſt always abſent, yet 36 parts of it, 48 of iron, and one of copper, were formed by fuſion into a globule, the ſpecific gravity of which was 8.8571, but was little ſoluble in nitrous acid; yet after lying about two hours in the acid, the gold was plainly to be ſeen, and with volatile alkali the menſtruum yielded nothing but a ferruginous brown precipitate, which in the fire put on the appearance of calcined iron.

The ſolutions of nickel in all the acids are green. The vitriolic ſcarcely attacks the regulus unleſs by evaporation to dryneſs. The nitrous acid, by the aſſiſtance of heat, diſſolves both the calx and the regulus: as does likewiſe the marine acid, but ſlowly, and not without the aſſiſtance of heat. Acid of arſenic unites with the calx into a green ſaline maſs; but with the regulus it ſeparates a ſaline powder difficult of fuſion. Fluor acid diſſolves the calx with difficulty, and forms cryſtals of a diluted green colour. Acid of borax ſcarce diſſolves nickel directly, but takes it up by a double elective attraction. Vinegar forms with the calx ſpathoſe cryſtals of an intenſe green colour, which can ſcarce be decompoſed by acid of tartar. The ſaccharine acid converts both regulus and calx into a white powder, not eaſily ſoluble in water. Acid of phoſphorus attracts it but little. The acid of ants by decoction or long digeſtion, attacks the newly precipitated calx; for the ſolution is green and upon evaporation yields cryſtals of a deep green colour, hemiſpherical, formed of filaments diverging from a centre and pellucid. They are not ſoluble in ſpirit of wine, and ſcarcely in water, unleſs it be acidulated. Lemon juice ſeems not to act at all upon nickel. All the acids are deeply tinged by diſſolving nickel: and this property belongs to the firſt regulus as well as that which is moſt highly depurated. Volatile alkali diſſolves it, and the ſolution is of a blue colour; the fixed alkali diſſolves it very ſparingly, and forms a yellow ſolution.

Nickel.

Nickel. Nickel becomes the more difficult of fusion, in proportion to its purity, so that at last it requires nearly as great a heat for this purpose as malleable iron. It is easily melted with other metals, but its great scarcity has prevented this matter from being thoroughly investigated. "It may, however, be observed, that the impure regulus cannot be united with silver, which must be attributed to the cobalt it contains; for when well freed from that metal, it easily unites in equal proportions with silver, and that without any remarkable diminution of the whiteness or ductility of the latter. This mixture, fused with borax, tinges it of an hyacinthine colour. Copper unites more slowly with depurated nickel, yielding a red and ductile metallic mass, which tinges borax of a reddish hyacinthine colour. It produces only a brittle mass with tin; in which respect it differs from cobalt. It could not be amalgamated with mercury by trituration.

Nickel, when well depurated, does not easily part with its phlogiston, or, in the language of the new nomenclature, receive an accession of carbone; for it only assumes a brown colour, and that with great difficulty in the ordinary way of calcination in the assay furnace. By means of nitre, however, it is more completely dephlogisticated, and becomes green. The metallic calx, vitrified with borax, produces an hyacinthine tinge; which yet, if occasioned by a regulus not well depurated, vanishes on continuing the fire, a slight blue tinge being produced by the addition of nitre; but a calx of well depurated regulus of nickel forms a permanent colour. The calx of nickel communicates also a hyacinthine colour to microcosmic salt; which, by long continued fusion on charcoal, may indeed be weakened, but can hardly be quite discharged. On the addition of nitre it changes to a violet, but becomes again hyacinthine on augmenting the quantity of microcosmic salt. If the calx of nickel be added to saturation, the fused glass assumes a blood colour; but on being fused, becomes more and more yellow.

Under the article Chemistry, N° 1316, and in the present article, we have observed, that Mr Bergman conjectures nickel to be only a modification of iron. He examines, however, with great care, the opinion of other authors, who suppose it to be composed of arsenic, copper, cobalt, and iron.—" With respect to arsenic (says he) we may very safely exclude it from the number; as experiments show that it may be entirely expelled. It cannot be doubted but that copper is present in some ores of nickel, and therefore may easily be mixed with the regulus; but the greater number are entirely without it. It is true, that nickel is totally soluble in volatile alkali, and that this solution is of a blue colour; but if this argument held good, there would be nothing found here but copper; in which case very different phenomena would take place from those which are produced by nickel. The blue colour, produced both by copper and nickel, can no more prove their identity than the yellow colour produced both by gold and iron, when dissolved in aqua regia, can prove the identity of these two metals. Nickel and copper agree also in this property, that they are both precipitated from acids and from volatile alkali by iron; but a considerable difference appears in the manner in which this precipitation is accomplished. When a polished piece of iron is put into a solution of nickel, a yellow pellicle of the latter will by degrees adhere to it; but this soon disappears on touching, and grows black, unless the acid be well saturated, or sufficiently diluted with water. A similar precipitation is observed if zinc be made use of instead of iron; but in solution of copper so much diluted, that the precipitation on iron may be nearly similar to that of nickel, zinc is immediately covered with a crust of the colour of mountain brass."

An invincible argument that cobalt is no essential ingredient in nickel is, that a solution of the latter in hepar sulphuris is precipitated by the former. In the same way nickel tinging borax, or the microcosmic salt, in the dry way, is thrown down by the addition of a proper quantity of copper; but this is not the case with cobalt. A remarkable difference likewise occurs with all the acids. 1. Cobalt tinges all these menstrua of a red colour, yielding crystals either of a yellow or bluish red. But nickel produces solutions and concretions of a fine green; it sometimes happens, indeed, that the red solutions yield greenish crystals; but this is to be attributed to nickel in small proportion mixed with the cobalt. 2. Cobalt united with the marine acid yields sympathetic ink, but depurated nickel does not. 3. Cobalt, dissolved in volatile alkali, affords a red solution, but nickel dissolved in the same alkali is blue. 4. Cobalt does not, like nickel, separate, on the addition of arsenical acid, a powder difficult of solution. Iron therefore only remains; and indeed, says Mr Bergman, there are many and weighty reasons, which induce us to think that nickel, cobalt, and manganese, are perhaps to be considered in no other light than modifications of iron.

1. Unequal portions of phlogiston, united to the same iron, or, according to the new nomenclature, iron containing different proportions of carbone, changes its qualities in a remarkable manner: for instance, how very much do the different kinds of iron and steel differ? It is then to be observed, that nickel, cobalt, and manganese, whatever operations they may be subjected to, are so far from being deprived of iron, that, on the contrary, they thereby become more ductile, magnetic, and refractory. Again, The various colours which nickel, cobalt, and manganese exhibit, both by solution and by fire, are also exhibited by iron. Cobalt and manganese occasion a red colour in acids, and the latter in glass; nickel and manganese occasion a hyacinthine colour when fused with borax; a green is produced in acids by nickel, as also by its calx, and by manganese when long and strongly calcined; and it often leaves behind a scoria of the same colour, if the reduction be performed with a saline flux. Lastly, Cobalt occasions a blue or rather violet colour in glass; and the same is true of manganese dissolved in fixed, and of nickel in volatile, alkali. Iron exhibits all these varieties; for the acids form with this metal solutions of a green colour as long as it contains a certain quantity of phlogiston; but in proportion to the diminution of this principle, a yellow, red, or brownish red, colour is produced. It tinges glass in the same manner, green, yellow, black, or red. Exposed to the fire for many hours together with nitre, blue, greenish blue, or greenish purple flowers, indeed are transmitted through the crucible; but an efflorescence of the same kind is produced by nitre alone, which, by long continued fire, penetrates the vessels, and is decomposed by the contact of the burning fuel, the alkaline efflorescences

refcences being made blue by the manganefe, which is always prefent in the circumjacent afhes; and thefe verge more to a green in proportion as the crocus martis is more copious; befides, iron itfelf is often found mixed with manganefe. Hence therefore it appears, that the blue flowers which are expelled from nickel by means of nitre are the produce of manganefe, as thefe impart to glafs nothing of the cobalt colour; befides, in the mineral kingdom, we find the nephritic ftones, and many others of blue, yellow, red, and green colours, all proceeding from iron alone.

The ores already mentioned, from which nickel has been obtained, are as follow:

1. Mr Rinman afferts, that it has been found native in a mine of cobalt in Heffe. It is very heavy, and of a liver colour or dark red. When pulverized, and roafted under a muffle, it forms green excrefcences, and fmokes; but its fmoke has no particular fmell, nor can any fublimate, either fulphureous or arfenical, be caught. It is foluble in acids, and the folution is green, but a polifhed iron plate difcovers no copper.

2. Aerated nickel is found in form of a calx, and is commonly mixed with the calx of iron; in which cafe it has the name of *nickel-ochre*. This is green, and is found in form of flowers on *kupfer-nickel*. It has been found in Sweden, without any vifible quantity of nickel in its compofition, in clay which contained much filver.

3. *Kupfer-nickel* is of a reddifh yellow bright colour, as has already been mentioned, and its texture is either uniform, granular, or fcaly. It is bright when broken, very heavy, and generally covered with a greenifh efflorefcence. By calcination it lofes much of its fulphur, and becomes green, forming fungous ramifications. Mr Rafpe informed M. Magellan, that nickel was found mineralized with fulphurated iron and copper in a mine near Nelfton in Cornwall. The fine grained and fcaly kinds are found in loofe cobalt mines in the province of Helfingeland in Sweden, where they are of a lighter colour than in other countries, and have often been confounded with the liver-coloured marcafite.

4. Nickel mineralized with the acid of vitriol is of a beautiful green colour, and may be extracted from the nickel-ochre, or green efflorefcences of kupfer-nickel already mentioned.

To the properties of nickel already mentioned, we may add that of its being conftantly attracted by the magnet, and that not at all in proportion to the quantity of iron it contains; for the more it is purified from this metal, the more magnetical it becomes; and even acquires what iron does not, viz. the properties of a true loadftone.

NICOBAR ISLANDS, the name of feveral iflands in Afia, lying at the entrance of the gulf of Bengal. The largeft of thefe iflands is about 40 miles long and 15 broad, and the inhabitants are faid to be a harmlefs fort of people, ready to fupply the fhips that ftop there with provifions. The fouth end of the great Nicobar is by Captain Ritchie placed in eaft longitude 94° 23′ 30″; and we collect from Mr Rennel's Memoir, that it is within the 12th degree of north latitude.

Of thefe iflands very little that can be depended upon is known in Europe. Of the northernmoft, which is called *Carnicobar*, we have indeed, in the fecond volume of the Afiatic Refearches, fome interefting information refpecting both the produce and natural hiftory of the country, and the manners of its inhabitants. The author of the memoir is Mr G. Hamilton, who, in his account of this ifland, fays, "It is low, of a round figure, about 40 miles in circumference, and appears at a diftance as if entirely covered with trees: however, there are feveral well cleared and delightful fpots upon it. The foil is a black kind of clay, and marfhy. It produces in great abundance, and with little care, moft of the tropical fruits, fuch as pine apples, plantains, papayes, cocoa-nuts, and areca-nuts; alfo excellent yams, and a root called *cachu*. The only four-footed animals upon the ifland are, hogs, dogs, large rats, and an animal of the lizard kind, but large, called by the natives *tolonqui*; thefe frequently carry off fowls and chickens. The only kind of poultry are hens, and thofe not in great plenty. There are abundance of fnakes of many different kinds, and the inhabitants frequently die of their bites. The timber upon the ifland is of many forts, in great plenty, and fome of it remarkably large, affording excellent materials for building or repairing fhips.

"The natives are low in ftature but very well made, and furprifingly active and ftrong; they are copper coloured, and their features have a caft of the Malay, quite the reverfe of elegant. The women in particular are extremely ugly. The men cut their hair fhort, and the women have their heads fhaved quite bare, and wear no covering but a fhort petticoat, made of a fort of rufh or dry grafs, which reaches half way down the thigh. This grafs is not interwoven, but hangs round the perfon fomething like the thatching of a houfe. Such of them as have received prefents of cloth petticoats from the fhips, commonly tie them round immediately under the arms. The men wear nothing but a narrow ftrip of cloth about the middle, in which they wrap up their privities fo tight that there hardly is any appearance of them. The ears of both fexes are pierced when young; and by fqueezing into the holes large plugs of wood, or hanging heavy weights of fhells, they contrive to render them wide, and difagreeable to look at. They are naturally difpofed to be good humoured and gay, and are very fond of fitting at table with Europeans, where they eat every thing that is fet before them; and they eat moft enormoufly. They do not care much for wine, but will drink bumpers of *arack* as long as they can fee. A great part of their time is fpent in feafting and dancing. When a feaft is held at any village, every one that choofes goes uninvited, for they are utter ftrangers to ceremony. At thofe feafts they eat immenfe quantities of pork, which is their favourite food. Their hogs are remarkably fat, being fed upon the cocoa nut kernel and fea water; indeed all their domeftic animals, fowls, dogs, &c. are fed upon the fame. They have likewife plenty of fmall fea fifh, which they ftrike very dexteroufly with lances, wading into the fea about knee deep. They are fure of killing a very fmall fifh at 10 or 12 yards diftance. They eat the pork almoft raw, giving it only a hafty grill over a quick fire. They roaft a fowl by running a piece of wood through it,

Nicobar. it, by way of spit, and holding it over a brisk fire until the feathers are burnt off, when it is ready for eating, in their taste. They never drink water; only cocoa-nut milk and a liquor called *soura*, which oozes from the cocoa-nut tree after cutting off the young sprouts or flowers. This they suffer to ferment before it be used, and then it is intoxicating; to which quality they add much by their method of drinking it, by sucking it slowly through a small straw. After eating, the young men and women, who are fancifully dressed with leaves, go to dancing, and the old people surround them smoking tobacco and drinking *soura*. The dancers, while performing, sing some of their tunes, which are far from wanting harmony, and to which they keep exact time. Of musical instruments they have only one kind, and that the simplest. It is a hollow bamboo about 2½ feet long and three inches in diameter, along the outside of which there is stretched from end to end a single string made of the threads of a split cane, and the place under the string is hollowed a little to prevent it from touching. This instrument is played upon in the same manner as a guitar. It is capable of producing but few notes; the performer however makes it speak harmoniously, and generally accompanies it with the voice.

"Their houses are generally built upon the beach, in villages of 15 or 20 houses each; and each house contains a family of 20 persons and upwards. These habitations are raised upon wooden pillars about 10 feet from the ground; they are round, and, having no windows, are like bee-hives, covered with thatch. The entry is through a trap door below, where the family mount by a ladder, which is drawn up at night. This manner of building is intended to secure the houses from being infested with snakes and rats; and for that purpose the pillars are bound round with a smooth kind of leaf, which prevents animals from being able to mount; besides which, each pillar has a broad round flat piece of wood near the top of it, the projecting of which effectually prevents the further progress of such vermine as may have passed the leaf. The flooring is made with thin strips of bamboos, laid at such distances from one another as to leave free admission for light and air; and the inside is neatly finished and decorated with fishing lances, nets, &c.

"The art of making cloth of any kind is quite unknown to the inhabitants of this island; what they have is got from the ships that come to trade in cocoa-nuts.

"They purchase a much larger quantity of cloth than is consumed upon their own island. This is intended for the Choury market. Choury is a small island to the southward of theirs, to which a large fleet of their boats sails every year about the month of November, to exchange cloth for canoes; for they cannot make these themselves. This voyage they perform by the help of the sun and stars, for they know nothing of the compass.

"In their disposition there are two remarkable qualities. One is their entire neglect of compliment and ceremony; and the other, their aversion to dishonesty. A Carnicobarian travelling to a distant village, upon business or amusement, passes through many towns in his way without speaking to any one; if he is hungry or tired, he goes into the nearest house, and helps himself to what he wants, and sits till he is rested, without taking the smallest notice of any of the family unless he has business or news to communicate. Theft or robbery is so very rare amongst them, that a man going out of his house never takes away his ladder or shuts his door, but leaves it open for any body to enter that pleases, without the least apprehension of having any thing stolen from him.

"Their intercourse with strangers is so frequent, that they have acquired in general the barbarous Portuguese so common over India; their own language has a sound quite different from most others, their words being pronounced with a kind of stop, or catch in the throat, at every syllable.

"They have no notion of a God, but they believe firmly in the devil, and worship him from fear. In every village there is a high pole erected with long strings of ground rattans hanging from it, which, it is said, has the virtue to keep him at a distance. When they see any signs of an approaching storm, they imagine that the devil intends them a visit, upon which many superstitious ceremonies are performed. The people of every village march round their own boundaries, and fix up at different distances small sticks split at the top, into which split they put a piece of cocoa-nut, a wisp of tobacco, and the leaf of a certain plant; whether this is meant as a peace offering to the devil, or a scarecrow to frighten him away, does not appear.

"When a man dies, all his live stock, cloth, hatchets, fishing lances, and in short every moveable thing he possessed, is buried with him, and his death is mourned by the whole village. In one view this is an excellent custom, seeing it prevents all disputes about the property of the deceased amongst his relations. His wife must conform to custom by having a joint cut off from one of her fingers; and if she refuses this, she must submit to have a deep notch cut in one of the pillars of her house.

"I was once present at the funeral of an old woman. When we went into the house which had belonged to the deceased, we found it full of her female relations; some of them were employed in wrapping up the corpse in leaves and cloth, and others tearing to pieces all the cloth which had belonged to her. In another house hard by, the men of the village with a great many others from the neighbouring towns, were sitting drinking *soura* and smoking tobacco. In the mean time two stout young fellows were busy digging a grave in the sand near the house. When the women had done with the corpse, they set up a most hideous howl, upon which the people began to assemble round the grave, and four men went up into the house to bring down the body; in doing this they were much interrupted by a young man, son to the deceased, who endeavoured with all his might to prevent them, but finding it in vain, he clung round the body, and was carried to the grave along with it: there, after a violent struggle, he was turned away and conducted back to the house. The corpse being now put into the grave, and the lashings which bound the legs and arms cut, all the live stock which had been the property of the deceased, consisting of about

about half a dozen hogs, and as many fowls, was killed, and flung in above it; a man then approached with a bunch of leaves stuck upon the end of a pole, which he swept two or three times gently along the corpse, and then the grave was filled up. During the ceremony, the women continued to make the most horrible vocal concert imaginable: the men said nothing. A few days afterwards, a kind of monument was erected over the grave, with a pole upon it, to which long strips of cloth of different colours were hung.

"Polygamy is not known among them; and their punishment of adultery is not less severe than effectual. They cut, from the man's offending member, a piece of the foreskin proportioned to the frequent commission or enormity of the crime.

"There seems to subsist among them a perfect equality. A few persons, from their age, have a little more respect paid to them; but there is no appearance of authority one over another. Their society seems bound rather by mutual obligations continually conferred and received; the simplest and best of all ties."

It is our wish to take all opportunities of laying before our readers every authentic fact which can throw light upon the philosophy of the human mind. In this narrative of Mr Hamilton's respecting the natives of Carnicobar, there is however one circumstance at which we stumble. It is known to the learned, that the philosophers of Greece and Rome, as well as the magi of Persia, admitted two self-existent beings, a good and an evil (see Polytheism); but we never before read of any people who had no notion of a God, and yet firmly believed in the devil. We could give instances of men worshipping the evil principle from fear, and neglecting the worship of the benevolent principle from a persuasion that he would do them all the good in his power without being bribed by sacrifices and oblations; but this is the only instance of which we have ever heard, of a people, under the influence of religion, who had *no notion of a God!* As good is at least as apparent in the world as evil, it appears to us so very unnatural to admit an *evil* and deny a *good* principle, that we cannot help thinking that Mr Hamilton, from his ignorance of the language of Carnicobar, (which he acknowledges to be different from most others), has not a perfect acquaintance with the religious creed of the natives: and that they believe in a good as well as in an evil principle, though they worship only the latter, from a persuasion, that to adore the former could be of no advantage either to him or to themselves.

NICODEMUS, a disciple of Jesus Christ, a Jew by nation, and by sect a Pharisee (John iii. 1. &c.) The Scripture calls him a ruler of the Jews, and our Saviour gives him the name of a master of Israel. When our Saviour began to manifest himself by his miracles at Jerusalem, at the first passover that he celebrated there after his baptism, Nicodemus made no doubt but that he was the Messiah, and came to him by night, that he might learn of him the way of salvation. Jesus told him, that no one could see the kingdom of heaven except he should be born again. Nicodemus taking this in the literal sense, made answer, "How can a man that is old be born again? Can he enter a second time into his mother's womb?" To which Jesus replied, "If a man be not born of water and of the spirit, he cannot enter into the kingdom of God. That which is born of the flesh is flesh, and that which is born of the spirit is spirit." Nicodemus asks him, "How can these things be?" Jesus answered, "Are you a master of Israel, and are you ignorant of these things? We tell you what we kn[illegible], and you receive not our testimony. If you believe not common things, and which may be called earthly, how will you believe me if I speak to you of heavenly things? Nobody has ascended into heaven but the Son of God, who came down from thence. And just as Moses lifted up the brazen serpent in the wilderness, so must the Son of Man be lifted up on high. For God so loved the world that he has given his only Son, so that no man who believes in him shall perish, but shall have eternal life."

After this conversation Nicodemus became a disciple of Jesus Christ; and there is no doubt to be made, but he came to hear him as often as our Saviour came to Jerusalem. It happened on a time, that the priests and Pharisees had sent officers to seize Jesus (John vii. 45, &c.), who returning to them, made their report, that never man spoke as he did; to which the Pharisees replied, "Are you also of his disciples? Is there any one of the elders or Pharisees that have believed in him?" Then Nicodemus thought himself obliged to make answer, saying, "Does the law permit us to condemn any one before he is heard?" To which they replied, "Are you also a Galilean? Read the Scriptures, and you will find that never any prophet came out of Galilee." After this the council was dismissed. At last Nicodemus declared himself openly a disciple of Jesus Christ (*Id.* xix. 39, 40.), when he came with Joseph of Arimathea to pay the last duties to the body of Christ, which they took down from the cross, embalmed, and laid in a sepulchre.

We are told, that Nicodemus received baptism from the disciples of Christ; but it is not mentioned whether before or after the passion of our Lord. It is added, that the Jews being informed of this, deposed him from his dignity of senator, excommunicated him, and drove him from Jerusalem: but that Gamaliel, who was his cousin-german, took him to his country house, and maintained him there till his death, when he had him buried honourably near St Stephen. There is still extant an apocryphal gospel under the name of Nicodemus, which in some manuscripts bears the title of the *Acts of Pilate*.

NICOLAITANS, in church history, Christian heretics who assumed this name from Nicholas of Antioch; who, being a Gentile by birth, first embraced Judaism and then Christianity; when his zeal and devotion recommended him to the church of Jerusalem, by whom he was chosen one of the first deacons. Many of the primitive writers believe that Nicholas was rather the occasion than the author of the infamous practices of those who assumed his name, who were expressly condemned by the Spirit of God himself, Rev. ii. 6. And indeed their opinions and actions were highly extravagant and criminal. They allowed a community of wives, and made no distinction between ordinary meats and those offered to idols. According to Eusebius, they subsisted but a short time;

time; but Tertullian says, that they only changed their name, and that their heresies passed into the sect of the Cainites.

NICOLAS (St), an island of the Atlantic ocean, and one of the most considerable of those of Cape Verde, lying between Santa Lucia and St Jago. It is of a triangular figure, and about 75 miles in length. The land is stony, mountainous, and barren; but there are a great many goats in a valley inhabited by the Portuguese. W. Long. 33. 35. N. Lat. 17. 0.

NICOLE (Peter), one of the finest writers in Europe, was born at Chartres in 1625, of a conspicuous family. He adhered to the Jansenists; and joined in the composition of several works with Mr Arnauld, whose faithful companion he was during the 10 or 12 years of his retirement. He gave a Latin translation of Pascal's *Provinciales*, and added a commentary to them. One of his finest works is his *Essais de Morale*. He wrote very subtilely against the Protestants. His treatise on the unity of the church is esteemed a masterly piece. He died at Paris in 1695, a few days after the publication of his treatise concerning the Quietists. He was well skilled in polite literature. To him is ascribed a collection of Latin epigrams, and of Greek, Spanish, and Italian sentences, which has borne several impressions, and has a learned preface to it.

NICOLO (St), the most considerable, strongest, and best peopled of the isles of Tremeti in the gulf of Venice, to the east of St Domino, and to the south of Capparata. It has a harbour defended by several towers; and a fortress, in which is an abbey, with a very handsome church. E. Long. 15. 37. N. Lat. 42. 7.

NICOMEDES, the name of several kings of the ancient Bithynia. See Bithynia.

Nicomedes I. had no sooner taken possession of his father's throne, before Christ 270, than, according to the custom which has in all ages been too prevalent among the despots of the east, he caused two of his brothers to be put to death. The youngest, Zibœas, having saved himself by timely flight, seized on the coast of Bithynia, which was then known by the names of *Thracia Thyniccia*, and *Thracia Asiatica*, and there maintained a long war with his brother. Nicomedes being informed that Antiochus Soter, king of Syria, was making great preparations to attack him at the same time, called in the Gauls to his assistance; and on this occasion that people first passed into Asia.— Nicomedes having with their assistance repulsed Antiochus, overcome his brother, and acquired the possession of all his father's dominions, bestowed upon them that part of Asia Minor which from them was called *Gallo-Gracia*, and Gallatia. Having now no enemies to contend with, he applied himself to the enlarging and adorning of the city of Astacus, which he called after his own name *Nicomedia*. He had two wives, and by one of them he was persuaded to leave his kingdom to her son, in preference to his elder brothers; but when or how he died is not certainly known.

Nicomedes II. the grandson of the former, began his reign like him, by sacrificing his brothers to his jealousy, after having waded to the throne in the blood of Prusias his father. He assumed the name of *Epiphanes*, or "the Illustrious," though he performed nothing worthy of this title, or even of notice, during the whole time of his long reign. He was succeeded by his son——

Nicomedes III. surnamed, by antiphrasis, *Philopater*, because he had murdered his father to get possession of his crown. This monarch having entered into alliance with Mithridates the Great king of Pontus, invaded Paphlagonia; and having seized on that country, he attempted likewise to make himself master of Cappadocia. This country, however, was at that time subject to his powerful ally; who thereupon marching into Bithynia at the head of an army, drove Nicomedes from the throne, and raised his brother Socrates to it in his room. The dethroned prince had recourse to the Romans, who expelled the usurper, and restored him to his hereditary dominions. For this favour they pressed him, and at length prevailed upon him, contrary to his own inclination, and the opinion of his friends, to make inroads into the territories of Mithridates, with whom Rome wanted a subject of dispute. The king of Pontus bore for some time the devastations committed by Nicomedes with great patience, that he might not seem to be the aggressor; but at last he routed his army on the banks of the Amnius, drove him a second time from his dominions, and obliged him to seek for shelter in Paphlagonia, where he led a private life till the time of Sylla, who replaced him on the throne. He was succeeded by his son——

Nicomedes IV. who performed nothing which the many writers who flourished in his time have thought worth transmitting to posterity. As he died without issue male, he left his kingdom by his last will to the Romans, who reduced it to the form of a province. Sallust, disagreeing with the ancients, tells us, that Nicomedes left a son named *Musa* or *Mysa*; and introduces Mithridates as complaining of the Romans to Arsaces king of Parthia, for seizing on the kingdom of Bithynia, and excluding the son of a prince who had on all occasions shown himself a steady friend to their republic. But this Musa was the daughter and not the son of Nicomedes, as we are told in express terms by Suetonius, Velleius Paterculus, and Appian. All we know of her is, that upon the death of her father she claimed the kingdom of Bithynia for her son, as the next male heir to the crown, but without success; no motives of justice being of such weight with the ambitious Romans as to make them part with a kingdom.

NICOMEDIA (anc. geog.), metropolis of Bithynia, built by Nicomedes the grandfather of Prusias. Situated on a point of the Sinus Astacenus, (Pliny); surnamed the *Beautiful*, (Athenæus): the largest city of Bithynia, (Pausanias), who says it was formerly called *Astacus*; though Pliny distinguishes Astacum and Nicomedia as different cities. Nicomedia was very famous, not only under its own kings, but under the Romans: it was the royal residence of Dioclesian, and of Constantine while Constantinople was building, if we may credit Nicephorus. It is still called *Nicomedia*, at the bottom of a bay of the Propontis in the Hither Asia. E. Long. 30. 0. N. Lat. 41. 20.



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It is a place of consequence; carries on a trade in silk, cotton, glass, and earthen ware, and is the see of a Greek archbishop.

NICOMEDUS, a geometrician, famous on account of the invention of the curve called *conchoid*, which is equally useful in resolving the two problems of doubling the cube and trisecting the angle. It appears that he lived soon after Eratosthenes, for he rallied that philosopher on the mechanism of his mesolabe. Geminus, who lived in the second century before Jesus Christ, has written on the conchoid, though Nicomedus was always esteemed the inventor of it. Those who place him four or five centuries after Jesus Christ must be ignorant of these facts, by which we are enabled to ascertain pretty nearly the time in which he lived.

NICON, a native of Russia, was born in 1613, in a village of the government of Nishnei Novogorod, of such obscure parents, that their names and station are not transmitted to posterity. He received at the baptismal font the name of *Nikita*, which afterwards, when he became monk, he changed to *Nicon*, the appellation by which he is more generally known. He was educated in the convent of St Macarius, under the care of a monk. From the course of his studies, which were almost solely directed to the Holy Scriptures, and the exhortations of his preceptor, he imbibed at a very early period the strongest attachment to a monastic life; and was only prevented from following the bent of his mind by the persuasions and authority of his father. In conformity, however, to the wishes of his family, though contrary to his own inclination, he entered into matrimony; and, as that state precluded him from being admitted into a convent, he was ordained a secular priest. With his wife he continued ten years, partly in the country and partly at Moscow, officiating as a parish priest. The loss of three children, however, gave him a total disgust to the world; in consequence of which, his wife was persuaded to take the veil, and he became a monk; his retreat was in an island of the White sea, and a kind of ecclesiastical establishment was formed, as remarkable for the austerities of its rules as the situation was for its solitude. There were about 12 monks, but they all lived in different cells. Such a system, combined with the most gloomy ideas, occasioned so much cloistered pride as tarnished his character, when he was afterwards called up to fulfil the duties of a public and exalted station. Our limits do not permit us to be minute in our account of his life, we must therefore be contented with barely reciting general facts. Within less than the space of five years, Nicon was successively created archimandrite, or abbot of the Novospatskoi convent, archbishop of Novogorod, and patriarch of Russia. That he was worthy of these rapid promotions, few will doubt who are acquainted with his character; for he was possessed of very extraordinary qualities, such as even his enemies allow and admire. His courage was undaunted, his morals irreproachable, his charity extensive and exalted, his learning deep and comprehensive, and his eloquence commanding.—When archbishop, he obtained the respect of the inhabitants by his unwearied assiduity in the discharge of his trust; and conciliated their affections by acts of unbounded charity: Nor was he less conspicuous in the discharge of the office of patriarch, to which dignity he was appointed in 1652, in the 39th year of his age.

Nor was he only distinguished in his own profession, for he shone even as a statesman. At length, however, he fell a victim to popular discontents; which misfortune, though he was far from deserving it, was certainly the effect of imprudence. He abdicated the office of patriarch, which would otherwise have been taken from him, in July 1658, and bore his reverse of fortune with heroic magnanimity: he returned to a cell, and commenced his former austerities. His innocence, however, could not protect him from further malice: his enemies obtained him to be formally deposed in 1666. This degradation was followed by imprisonment, which was for some time very rigorous, because he, conscious of his own innocence, refused to accept pardon for crimes of which he was not guilty. In 1676, however, he was removed to the convent of St Cyril, and enjoyed perfect liberty.

Nicon survived his deposition 15 years. In 1681, he requested and obtained permission to return to the convent of Jerusalem, that he might end his days in that favourite spot; but he expired upon the road near Yaroslaf, in the 66th year of his age. His remains were transported to that convent, and buried with all the ceremonies used at the interment of patriarchs.

NICOPOLI, a town of Turkey in Europe, and in Bulgaria, famous for being the place where the first battle was fought between the Turks and Christians in 1396; and where the latter were defeated with the loss of 20,000 men. E. Long. 25. 33. N. Lat. 43. 46.

NICOSIA, the capital of the island of Cyprus, where a Turkish bashaw resides. It is delightfully situated between the mountains of Olympus and a chain of others, and was formerly well fortified by the Venetians; but the works are now in ruins. It is about 31 miles in circumference; and there are plantations of olives, almonds, lemons, oranges, mulberries, and cypress trees, interspersed among the houses, which give the town a delightful appearance. The church of Sancta Sophia is an old Gothic structure, which the Turks have turned into a mosque, and destroyed the ornaments. It is 100 miles west of Tripoli, and 160 south-west of Aleppo. E. Long. 34. 45. N. Lat. 34. 54.

NICOT (John), lord of Villemain, and master of requests of the French king's household, was born at Nismes, and was sent ambassador to Portugal in 1559; whence he brought the plant which, from his name, was called *Nicotiana*, but is now more generally known by the name of *Tobacco*. He died at Paris in 1603. He wrote a French and Latin dictionary in folio: a treatise on navigation; and other works.

NICOTIANA, TOBACCO, in botany: a genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 28th order, *Luridæ*. The corolla is funnel-shaped, with a plaited limb; the stamina inclined; the capsule bivalved and bilocular. There are seven species, of which the most remarkable is the *tabaccum*, or common tobacco plant. This was first discovered in America by the Spaniards about the year 1560, and by

Nicotiana by them imported into Europe. It had been used by the inhabitants of America long before; and was called by those of the islands *yoli*, and *petun* by the inhabitants of the continent. It was sent into Spain from Tabaco, a province of Yucatan, where it was first discovered, and from whence it takes its common name. Sir Walter Raleigh is generally said to have been the first that introduced it into England about the year 1585, and who taught his countrymen how to smoke it. Dr Cotton Mather, however, (in his Christian Philosopher) says, that in the above year one Mr Lane carried over some of it from Virginia, which was the first they had ever been seen in Europe. Tobacco is commonly used among the oriental nations, though it is uncertain by whom it was introduced among them. Considerable quantities of it are cultivated in the Levant, on the coasts of Greece and the Archipelago, in Italy, and in the island of Malta.

There are two varieties of that species of nicotiana which is cultivated for common use, and which are distinguished by the names of *Oronokoe*, and *sweet-scented tobacco*. They differ from each other only in the figure of their leaves; those of the former being longer and narrower than the latter. They are tall herbaceous plants, growing erect with fine foliage, and rising with a strong stem from six to nine feet high. The stalk near the root, is upward of an inch diameter, and surrounded with a kind of hairy or velvet clammy substance, of a yellowish green colour. The leaves are rather of a deeper green, and grow alternately at the distance of two or three inches from each other. They are oblong, of a spear-shaped oval, and simple; the largest about 20 inches long, but decreasing in size as they ascend, till they come to be only 10 inches long, and about half as broad. The face of the leaves is much corrugated, like those of spinage when full ripe. Before they come to maturity, when they are about five or six inches long, the leaves are generally of a full green, and rather smooth; but as they increase in size, they become rougher, and acquire a yellowish cast. The stem and branches are terminated by large bunches of flowers collected into clusters, of a delicate red; the edges, when full blown, inclining to a pale purple. They continue in succession till the end of the summer; when they are succeeded by seeds of a brown colour, and kidney shaped. These are very small, each capsule containing about 1000; and the whole produce of a single plant is reckoned at about 350,000. The seeds ripen in the month of September.

Mr Carver informs us, that the Oronokoe, or, as it is called, the *long Virginian tobacco*, is the kind best suited for bearing the rigour of a northern climate, the strength as well as the scent of the leaves being greater than that of the other. The *sweet-scented* sort flourishes most in a sandy soil, and in a warm climate, where it greatly exceeds the former in the celerity of its growth; and is likewise, as its name intimates, much more mild and pleasant.

*Culture.* Tobacco thrives best in a warm, kindly, rich soil, that is not subject to be overrun by weeds. In Virginia, the soil in which it thrives best is warm, light, and inclining to be sandy; and therefore, if the plant is to be cultivated in Britain, it ought to be planted in a soil as nearly of the same kind as possible. Other kinds of soil might probably be brought to suit it, by a mixture of proper manure; but we must remember, that whatever manure is made use of, must be thoroughly incorporated with the soil. The best situation for a tobacco plantation is the southern declivity of a hill rather gradual than abrupt, or a spot that is sheltered from the north winds: but at the same time it is necessary that the plants enjoy a free air; for without that they will not prosper.

As tobacco is an annual plant, those who intend to cultivate it ought to be as careful as possible in the choice of the seeds; in which, however, with all their care, they may be sometimes deceived. The seeds are to be sown about the middle of April, or rather sooner in a forward season, in a bed prepared for this purpose of such soil as has been already described, mixed with some warm rich manure. In a cold spring, hot beds are most eligible for this purpose, and gardeners imagine that they are always necessary: but Mr Carver tells us, that he is convinced, when the weather is not very severe, the tobacco seeds may be raised without doors; and for this purpose gives us the following directions. *Treatise on the Culture of Tobacco.*

"Having sown the seed in the manner above directed, on the least apprehension of a frost after the plants appear, it will be necessary to spread mats over the beds, a little elevated from the ground by poles laid across, that they may not be crushed. These, however, must be removed in the morning soon after the sun appears, that they may receive as much benefit as possible from its warmth and from the air. In this manner proceed till the leaves have attained about two inches in length and one in breadth; which they will do in about a month after they are sown, or near the middle of May, when the frosts are usually at an end. One invariable rule for their being able to bear removal is, when the fourth leaf is sprouted, and the fifth just appears. Then take the opportunity of the first rains or gentle showers to transplant them into such a soil and situation as before described; which must be done in the following manner.—The land must be ploughed, or dug up with spades, and made mellow and light as possible. When the plants are to be placed, raise with the hoe small hillocks at the distance of two feet or a little more from each other, taking care that no hard sods or lumps are in it; and then just indent the middle of each, without drilling holes, as for some other plants.

"When your ground is thus prepared, dig in a gentle manner from their native bed such plants as have attained the proper growth for transplanting above-mentioned; and drop, as you pass, one on every hillock. Insert a plant gently into each centre, pressing the soil around gently with your fingers; and taking the greatest care, during the operation, that you do not break off any of the leaves, which are at this time exquisitely tender. If the weather proves dry after they are thus transplanted, they must be watered with soft water, in the same manner as is usually done to coleworts, or plants of a similar kind. But though you now seem to have a sufficient quantity of plants for the space you intend to cultivate, it is yet necessary that you continue to attend to your bed of seedlings, that you may have enough to supply any deficiencies which through accident may arise. From this time great care must be taken to keep the ground soft and free

Nicotiana. free from weeds, by often stirring with your hoe the mould round the roots; and to prune off the dead leaves that sometimes are found near the bottom of the stalk.

"The difference of this climate from that in which I have been accustomed to observe the progress of this plant, will not permit me to direct with certainty the time which is most proper to take off the top of it, to prevent it from running to seed. This knowledge can only be acquired by experience. When it has risen to the height of more than two feet, it commonly begins to put forth the branches on which the flowers and seeds are produced; but as this expansion, if suffered to take place, would drain the nutriment from the leaves, which are the most valuable part, and thereby lessen their size and efficacy, it becomes needful at this stage to nip off the extremity of the stalk to prevent its growing higher. In some other climates, the top is commonly cut off when the plant has 15 leaves; but if the tobacco is intended to be a little stronger than usual, this is done when it has only 13; and sometimes, when it is designed to be remarkably powerful, 11 or 12 are only allowed to expand. On the contrary, if the planter is desirous of having his crop very mild, he suffers it to put forth 18 or 20: but in this calculation, the three or four lower leaves next the ground, which do not grow so large and fine as the others, are not be reckoned.

"This operation, denominated *topping* the tobacco, is much better performed by the finger and thumb than with any instrument; because the grasp of the fingers closes the pores of the plant; whereas, when it is done by instruments, the juices are in some degree exhausted. Care must also be taken to nip off the sprouts that will be continually springing up at the junction of the leaves with the stalks. This is termed *succouring*, or *suckering*, the tobacco; and ought to be repeated as often as occasion requires.

"As it is impossible to ascertain the due time for topping the plant, so it is equally impossible, without experiment, to ascertain the time it will take to ripen in this country. The apparent signs of its maturity are these: The leaves, as they approach a state of ripeness, become more corrugated or rough; and when fully ripe, appear mottled with yellowish spots on the raised parts; whilst the cavities retain their usual green colour. They are at this time also thicker than they have before been; and are covered with a downy velvet, like that formerly mentioned, on the stalks. If heavy rains happen at this critical period, they will wash off this excrescent substance, and thereby damage the plants. In this case, if the frosty nights are not begun, it is proper to let them stand a few days longer; when, if the weather be moderate, they will recover this substance again. But if a frost unexpectedly happens during the night, they must be carefully examined in the morning, before the sun has any influence upon them; and those which are found to be covered with frosty particles, whether thoroughly ripe or not, must be cut up; for though they may not all appear to be arrived at a state of maturity, yet they cannot be far from it, and will differ but little in goodness from those that are perfectly so."

Tobacco is subject to be destroyed by a worm; and without proper care to exterminate this enemy, a whole field of plants may soon be lost. This animal is of the horned species, and appears to be peculiar to the tobacco plant; so that in many parts of America it is distinguished by the name of the *tobacco worm*. In what manner it is first produced, or how propagated, is unknown; but it is not discernible till the plants have attained about half their height, and then appears to be nearly as large as a gnat. Soon after this it lengthens into a worm; and by degrees increases in magnitude to the bigness of a man's finger. In shape it is regular from its head to its tail, without any diminution at either extremity. It is indented or ribbed round at equal distances, nearly a quarter of an inch from each other; and having at every one of these divisions a pair of feet or claws, by which it fastens itself to the plant. Its mouth, like that of the caterpillar, is placed under the fore part of the head. On the top of the head, between the eyes, grows a horn about half an inch long, and greatly resembling a thorn; the extreme part of which is of a brown colour, a firm texture, and the extremity sharp pointed. It is easily crushed; being only, to appearance, a collection of green juice enclosed in a membraneous covering, without the internal parts of an animated being. The colour of its skin is in general green, interspersed with several spots of a yellowish white; and the whole covered with a short hair scarcely to be discerned. These worms are found the most predominant during the latter end of July and the beginning of August; at which time the plants must be particularly attended to, and every leaf carefully searched. As soon as a wound is discovered, and it will not be long before it is perceptible, care must be taken to destroy the cause of it, which will be found near it, and from its unsubstantial texture may easily be crushed: but the best method is to pull it away by the horn, and then crush it.

When the tobacco is fit for being gathered, as will appear from an attention to the foregoing directions, on the first morning that promises a fair day, before the sun is risen, take an axe or a long knife, and holding the stalk near the top with one hand, sever it from the root with the other, as low as possible. Lay it gently on the ground, taking care not to break off the leaves, and there let it remain exposed to the rays of the sun throughout the day, or until the leaves, according to the American expression, are entirely wilted; that is, till they become limber, and will bend any way without breaking. But if the weather should prove rainy without any intervals of sunshine, and the plants appear to be fully ripe, they must be housed immediately. This must be done, however, with great care, that the leaves, which are in this state very brittle, may not be broken. They are next to be placed under proper shelter, either in a barn or covered hovel, where they cannot be affected by rain or too much air, thinly scattered on the floor; and if the sun does not appear for several days, they must be left to wilt in that manner; but in this case the quality of the tobacco will not be quite so good.

When the leaves have acquired the above-mentioned flexibility, the plants must be laid in heaps, or rather in one heap if the quantity is not too great, and in about 24 hours they will be found to sweat. But during this time, when they have lain for a little while, and begin to ferment, it will be necessary to turn them;

them; bringing those which are in the middle to the surface, and placing those which are at the surface in the middle. The longer they lie in this situation, the darker coloured is the tobacco; and this is termed *sweating* the tobacco. After they have lain in this manner for three or four days, (for a longer continuance might make the plants turn mouldy,) they may be fastened together in pairs with cords or wooden pegs, near the bottom of the stalk, and hung across a pole, with the leaves suspended in the same covered place, a proper interval being left between each pair. In about a month the leaves will be thoroughly dried, and of a proper temperature to be taken down. This state may be ascertained by their appearing of the same colour with those imported from America. But this can be done only in wet weather.—The tobacco is exceedingly apt to attract the humidity of the atmosphere, which gives it a pliability that is absolutely necessary for its preservation; for if the plants are removed in a very dry season, the external parts of the leaves will crumble into dust, and a considerable waste will ensue.

*Cure.* As soon as the plants are taken down, they must again be laid in a heap, and pressed with heavy logs of wood for about a week; but this climate may possibly require a longer time.* While they remain in this state, it will be necessary to introduce your hand frequently into the heap, to discover whether the heat be not too intense; for in large quantities this will sometimes be the case, and considerable damage will be occasioned by it. When they are found to heat too much, that is, when the heat exceeds a moderate glowing warmth, part of the weight by which they are pressed must be taken away; and the cause being removed, the effect will cease. This is called the *second* or *last sweating;* and, when completed, which it generally will be about the time just mentioned, the leaves must be stripped from the stalks for use. Many omit this last sweating; but Mr Carver thinks that it takes away any remaining harshness, and renders the tobacco more mellow. The strength of the stalk also is diffused by it through the leaves, and the whole mass becomes equally meliorated.--When the leaves are stripped from the stalks, they are to be tied up in bunches or *hands*, and kept in a cellar or other damp place; though if not handled in dry weather, but only during a rainy season, it is of little consequence in what part of the house or barn they are laid up. At this period the tobacco is thoroughly cured, and as proper for manufacturing as that imported from the colonies.

Our author advises the tobacco planter, in his first trials, not to be too avaricious, but to top his plants before they have gained their utmost height: leaving only about the middle quantity of leaves directed before to give it a tolerable degree of strength. For though this, if excessive, might be abated during the cure by an increase of sweating, or be remedied the next season by suffering more leaves to grow, it can never be added; and, without a certain degree of strength, the tobacco will always be tasteless and of little value. On the contrary, though it be ever so much weakened by sweating, and thereby rendered mild, yet it will never lose the aromatic flavour, which accompanied that strength, and which greatly adds to its value. A square yard of land, he tells us, will rear about 500 plants, and allow proper space for their nurture till they are fit for transplanting.

The following extract, which is copied from a manuscript of Dr Barham (A), for directing the raising, cultivating, and curing tobacco in Jamaica, is perhaps worthy of the attention of those who wish to be further acquainted with this subject.

"Let the ground or woodland wherein you intend planting tobacco be well burned, as the greater the quantity of wood ashes the better. The spot you intend raising your plants on must be well strewed with ashes, laid smooth and light; then blow the seed from the palm of your hand gently on the bed, and cover it over with palm or plantain leaves.

"When your plants are about four inches high, draw them and plant them out about three feet asunder; and when they become as high as your knee, cut or pluck off the top; and if there are more than 12 leaves on the plant, take off the overplus, and leave the rest entire.

"The plant should now be daily attended to in order to destroy the caterpillars that are liable to infest it; as also to take off every sprout or sucker that puts out at the joints, in order to throw the whole vegetable nourishment into the large leaves.

"When the edges and points of the leaves begin to turn a little yellow, cut down the stalks about ten o'clock in the morning, taking the opportunity of a fine day, and be careful the dew is fully off the plant, and do not continue this work after two in the afternoon. As fast as it is cut let it be carried into your tobacco house, which must be so close as to shut out all air, (on this much depends), and hung up on lines tied across, for the purpose of drying.

"When the stalks begin to turn brownish, take them off the lines, and put them in a large binn, and lay on them heavy weights for 12 days; then take them out, and strip off the leaves, and put them again into the binn, and let them be well pressed, and so as no air gains admission for a month. Take them out; tie them in bundles about 60 leaves in each, which are called *monococs;* and are ready for sale. But observe to let them always be kept close till you have occasion to dispose of them.

"Let your curing house be well built, and very close and warm; if a boarded building, it will not be amiss, in a wet situation, to cover the whole outside with thatch and plantain trash, to keep off the damps; for by this care you preserve the fine volatile oil in the leaves. Observe, no smoke is to be made use of or admitted into your curing house.

*Use.* Since the introduction of tobacco into Europe 1560, various medical properties have been ascribed to it at different times by Stahl and other German physicians;

(A) This gentleman was cotemporary with Sir Hans Sloane. He was a man of great probity, an able physician, and a skilful naturalist. He collected and arranged a number of the plants of Jamaica, which he presented to Dr Sloane, and made several communications to the Royal Society.

Nicotiana.

cians; but the manner in which of late years it has been ſpoken of by the generality of writers on materia medica, has occaſioned it to be almoſt wholly diſmiſſed from modern practice, at leaſt from internal uſe; but this circumſtance has not deterred Dr Fowler, a phyſician of eminence in Staffordſhire, from commencing an inquiry into its medicinal effects; and he has given the reſult of his experiments, which ſeem to be accurately and faithfully related.

That tobacco, under proper regulations, may be adminiſtered internally, not only as a ſafe but as an efficacious remedy, eſpecially as a diuretic, in caſes of dropſy and dyſury, ſeems certain enough. This property, amongſt the vaſt number that have been attributed to it, however, ſeems ſcarcely ever to have been hinted at.

The forms in which Dr Fowler ordered it were either in infuſion, tincture, or pills.

Take of tobacco leaves dried, an ounce; boiling water, one pound: infuſe them for an hour in a cloſe veſſel ſet in a warm place, and ſtrain off about 14 ounces. Then add two ounces of rectified ſpirit of wine.

Take of dried tobacco leaves, an ounce; of rectified ſpirits; Spaniſh white wine, or vinegar, one pint: to be infuſed for four days.

Take of dried tobacco leaves in powder, one drachm; of the conſerve of roſes, enough to make it in a maſs; which is to be divided into 60 pills.

Of the infuſion, or tincture, Dr Fowler gives from ſix to 100 drops twice a day in water, or in a cordial julep, or other proper vehicle, ſufficient to produce the effect in adults; but in irritable habits he ſeldom exceeded 25 drops. To a patient of 10 years old he gave 50 drops; to a child of five years old 20 drops; but to patients under five years old he never ventured to preſcribe it.

The firſt effects of the infuſion is a tranſient heat in the ſtomach and throat, as if the patient had taken a dram. The next general effect in a moderate doſe is diuretic, with or without a ſlight vertigo and giddineſs, and frequently nauſea. In painful caſes, it proves anodyne, and in ſome caſes occaſions drowſineſs and ſleep; in others drowſineſs, with a ſenſe of heat and reſtleſſneſs.

Dr Fowler gave this medicine in 115 caſes: in 93 of which it proved diuretic; in 40 of theſe caſes it occaſioned purging; 79 of theſe patients complained of vertigo. In 52 of the number it excited nauſea; in the two laſt caſes he directs the medicine to be ſuſpended, and the doſes leſſened. Dr Fowler tried it in 30 caſes of dropſy, viz. four of anaſarca, or general dropſy; two of aſcites; and 12 of dropſical ſwellings of the legs, were all cured. In ten other caſes it afforded conſiderable relief; and in three caſes only it was of no uſe. In ten inſtances of dyſury, the infuſion was anodyne and diuretic, thereby abating pain, relaxing the urinary paſſages, and promoting urine.—In dyſuries from gravel, it facilitates the expulſion of calcareous or gritty matter.

Dr Fowler ſpeaks of the uſe of tobacco in injections; an ounce of the infuſion in a pint of water-gruel at a time, and repeated in caſes of obſtinate coſtipation, as the caſe may require. In the *dry bellyach*, in the Weſt Indies, injections of the ſmoke of tobacco have long been employed with the happieſt effects.

Nicotiana, Nictitating.

After all, the internal uſe of tobacco ſhould be very limited, and can only be ſafe in the hands of a ſkilful and attentive practitioner. Tobacco is ſometimes uſed externally in unguents for deſtroying cutaneous inſects, cleanſing old ulcers, &c. Beaten into a maſh with vinegar or brandy, it has ſometimes proved ſerviceable for removing hard tumours of the hypochondres: an account is given in the Edinburgh Eſſays of two caſes of this kind cured by it. The moſt common uſes of this plant, however, are either as a ſternutatory when taken by way of ſnuff, as a maſticatory by chewing it in the mouth, or as effluvia by ſmoking it; and when taken in moderation, it is not an unhealthful amuſement. Before pipes were invented, it was uſually ſmoked in ſegars, and they are ſtill in uſe among ſome of the ſouthern nations. The method of preparing theſe is at once ſimple and expeditious. A leaf of tobacco being formed into a ſmall twiſted roll, ſomewhat larger than the ſtem of a pipe, and about eight inches long, the ſmoke is conveyed through the winding folds which prevent it from expanding, as through a tube; ſo that one end of it being lighted, and the other applied to the mouth, it is in this form uſed without much inconvenience. But, in proceſs of time, pipes being invented, they were found more commodious vehicles for the ſmoke, and are now in general uſe.

Among all the productions of foreign climes introduced into theſe kingdoms, ſcarce any has been held in higher eſtimation by perſons of every rank than tobacco. In the countries of which it is a native, it is conſidered by the Indians as the moſt valuable offering that can be made to the beings they worſhip. They uſe it in all their civil and religious ceremonies. When once the ſpiral wreaths of its ſmoke aſcend from the feathered pipe of peace, the compact that has been juſt made is conſidered as ſacred and inviolable. Likewiſe, when they addreſs their great Father, or his guardian ſpirits, reſiding, as they believe, in every extraordinary production of nature, they make liberal offerings to them of this valuable plant, not doubting but that they are thus ſecured of protection.

Tobacco is made up into rolls by the inhabitants of the interior parts of America, by means of a machine called a *tolacco wheel*. With this machine they ſpin the leaves after they are cured, into a twiſt of any ſize they think fit; and having folded it into rolls of about 20 pounds each, they lay it by for uſe. In this ſtate it will keep for ſeveral years, and be continually improving, as it always grows milder. The Illinois uſually form it into carrots; which is done by laying a number of leaves, when cured, on each other after the ribs have been taken out, and rolling them round with packthread, till they become cemented together. Theſe rolls commonly meaſure about 18 or 20 inches in length, and nine round in the middle part.

Tobacco forms a very conſiderable article in commerce; for an account of which ſee the articles GLASGOW and VIRGINIA.

NICTITATING MEMBRANE, a thin membrane chiefly found in the bird and fiſh kind, which covers the eyes of theſe animals, ſheltering them from the duſt or too much light; yet is ſo thin and pellucid, that they can ſee pretty well through it.

NIDDUI, in the Jewish customs, is used to signify "separated or excommunicated." This, according to some, was to be understood of the lesser sort of excommunication in use among the Hebrews. He that had incurred it was to withdraw himself from his relations, at least to the distance of four cubits: it commonly continued a month. If it was not taken off in that time, it might be prolonged for 60 or even 90 days: but if, within this term, the excommunicated person did not give satisfaction, he fell into the cherem, which was a second sort of excommunication; and thence into the third sort, called *shammata* or *shematta*, the most terrible of all. But Selden has proved that there were only two kinds of excommunication, *viz.* the greater and less; and that these three terms were used indifferently.

NIDUS, among naturalists, signifies a nest or proper repository for the eggs of birds, insects, &c. where the young of these animals are hatching and nursed.

NIDIFICATION, a term generally applied to the formation of a bird's nest, and its hatching or bringing forth its young. See ORNITHOLOGY.

NIECE, a brother's or sister's daughter, which in the civil law is reckoned the third degree of consanguinity.

NIEMEN, a large river of Poland, which rises in Lithuania, where it passes by Bielica, Grodno, and Konno: it afterwards runs through part of Samogitia and Ducal Prussia, where it falls into the lake called the *Curisch-haff*, by several mouths, of which the most northern is called the *Russ*, being the name of a town it passes by.

NIENBURGH, a rich and strong town of Germany, in the duchy of Brunswic-Lunenburg, with a strong castle. It carries on a considerable trade in corn and wool, and is seated in a fertile soil on the river Weser. E. Long. 9. 26. N. Lat. 52. 44.

NIEPER, a large river of Europe, and one of the most considerable of the North, formerly called the Borysthenes. Its source is in the middle of Muscovy, running west by Smolensko, as far as Orsa; and then turns south, passing by Mohilow, Bohaczo, Kiow, Czyrkassy, the fortress of Kudak, Dessau, and Oczakow, falling into the Black sea; as also in its course it divides Little Tartary fom Budziac Tartary.

NIESS, a mountain in the environs of Berne in Switzerland. It is the last mountain in a high calcareous chain of hills, of which the Stockhorn, the Neuneren, and the Ganterish, have been illustrated by the botanical labours of the celebrated Haller. Niess stands on the borders of the lake Thun, and separates the valley of Frutingen from that of Simme. It is very interesting to the curious traveller, on account of the fine view from its top; and to naturalists, because it joins the Alps. Towards its foot, beds of slate have been discovered; it is of calcareous stone higher up; and near its top is found a species of pudding-stone, filled with small fragments of broken petrifactions.

NIESTER, a large river of Poland, which has its source in the Lake Niester, in the palatinate of Lemburg, where it passes by Halicz. Then it separates Podolia and Oczakow Tartary from Moldavia and Budziac Tartary; and falls into the Black sea at Belgorod, between the mouths of the Nieper and the Danube.



NIEUHOFF (John de), a Dutch author, was born about the beginning of the last century. We are indebted to him for a valuable and curious account, written in Dutch, of his embassy from the Dutch East India Company to the emperor of China. Jean le Carpentier published an excellent translation of it into French, in folio, Leyden, 1665. This edition is rare, and the book is in great request.

NIEUWENTYT (Bernard), an able philosopher and learned mathematician, was born at Westgraafdyk, in the year 1654, and became counsellor and burgomaster of the town of Purmerend, where he was esteemed for his integrity and learning, and died in 1718. He wrote, in Dutch, 1. An excellent treatise, entitled, The Existence of God demonstrated by the Works of Nature. 2. A Refutation of Spinoza. 3. Some Pieces against the Infinitesimals, &c.

NIGELLA, FENNEL-FLOWER, or *Devil in a Bush*: A genus of the pentagynia order, belonging to the pentandria class of plants. There is no calyx; the petals are five; and five trifid nectaria within the corolla; there are five connected capsules. There are five species, all of them natives of the warm parts of Europe, and rising from a foot to a foot and a half high, adorned with blue or yellow flowers. They are propagated by seeds, which in a dry and warm situation will thrive very well; and the plants ripen seeds in this country.

NIGER (C. Pescennius Justus), a celebrated governor in Syria, well known by his valour in the Roman armies while but a private man. At the death of Pertinax he was declared emperor of Rome; and his claims to that elevated station were supported by a sound understanding, prudence of mind, moderation, courage, and virtue. He proposed to imitate the actions of the venerable Antoninus, of Trajan, of Titus, and M. Aurelius. He was remarkable for his fondness of ancient discipline. He never suffered his soldiers to drink wine, but obliged them when thirsty to use water and vinegar. He forbade the use of silver or gold utensils in his camp. All the bakers and cooks were driven away, and the soldiers were ordered to live during the expedition they undertook merely upon biscuits. In his punishments Niger was inexorable: he condemned ten of his soldiers to be beheaded in the presence of the army because they had stolen and eaten a fowl. The sentence was heard with groans. The army interfered; and when Niger consented to diminish the punishment, for fear of kindling rebellion, he yet ordered the criminals to make each a restoration of ten fowls to the person whose property they had stolen. They were besides ordered not to light a fire the rest of the campaign, but to live upon cold aliments and to drink nothing but water. Such great qualifications in a general seemed to promise the restoration of ancient discipline in the Roman armies; but the death of Niger frustrated every hope of reform. Severus, who had also been invested with the imperial purple, marched against him: some battles were fought, and Niger was at last defeated, A.D. 195. His head was cut off and fixed to a long spear, and carried in triumph through the streets of Rome. He reigned about a year.

Niger, Night.

Niger, a great river of Africa, supposed to have its origin near that of the Nile; but this is very uncertain. We are assured, however, that it is a river of very great extent: especially if we suppose, according to the opinion of the best modern geographers, that it has its source in the kingdom of Gorhan, not far from the confines of Upper Ethiopia; for then it will cross almost the whole continent of Africa, where it is widest. In its course it receives many considerable rivers, which swell it high enough to be able at all times to carry vessels of good burden; it splits itself into several branches, which uniting again form very large and fertile islands, well filled with towns and villages. It passes also through several lakes, and has many cataracts. After having run from east to west during a prodigious long course, it turns at last short to the south, at a league and a half distance from the western ocean; leaving but a very narrow tract between it and the sea, into which it opens its way in lat. 15. 55. after having run about 25 leagues from north to south. Its mouth is sometimes half a league broad; but is shut up by a bank of quick sand, called the *bar of Senegal*, where the water is so shallow, that it is very difficult and dangerous to pass over it. The bar is formed by the mud and sand which the river brings with it during the inundation, and which the sea continually drives back upon the shore. This would effectually exclude all shipping, had not the violence of the current, and the weight of the waters, made two openings or channels, which are commonly called the *passes of the bar*. The largest of these is generally not above 150 or 200 fathoms broad, and about 10 feet deep, so that none but barks of 40 or 50 tons can get through this channel; the other is so narrow and shallow, that it is passable by canoes only. These channels are not always in the same place; for the river, as it is more or less swelled, or the current more or less rapid, open those passes sometimes in one place and sometimes in another. The bar itself also frequently shifts its place; so that the island of Senegal is sometimes four leagues distant from it, at other times only two. It is this bar only which hinders ships of 400 or 500 tons to go up the river. See Guinea and Negroland.

NIGHT, that part of the natural day during which the sun is underneath the horizon; or that space wherein it is dusky.

Night was originally divided by the Hebrews and other eastern nations into three parts or watches. The Romans, and after them the Jews, divided the night into four parts or watches; the first of which began at sunset, and lasted till nine at night, according to our way of reckoning; the second lasted till midnight; the third till three in the morning; and the fourth ended at sunrise. The ancient Gauls and Germans divided their time not by days but by nights; and the people of Iceland and the Arabs do the same at this day. The like is observed of the Anglo-Saxons.—The length and shortness of night or of darkness is according to the season of the year and position of the place; and the causes of this variety are now well known. See Astronomy, &c.

Night, in scripture language, is used for the times of heathenish ignorance and profaneness (Rom. xiii. 12.); for adversity and affliction (Is. xxi. 12.); and, lastly, for death (John ix. 4.)

Night-angling | Nightingale.

*Night-Angling*, a method of catching large and shy fish in the night time. Trout, and many other of the better sorts of fish, are naturally shy and fearful; they therefore prey in the night as the securest time.—The method of taking them on this plan is as follows: The tackle must be strong, and need not be so fine as for day fishing, when every thing is seen; the hook must be baited with a large earth worm, or a black snail, and thrown out into the river; there must be no lead to the line, so that the bait may not sink, but be kept drawling along, upon or near the surface. Whatever trout is near the place will be brought thither by the motion of the water, and will seize the worm or snail. The angler will be alarmed by the noise which the fish makes in rising, and must give him line, and time to swallow the hook; then a slight touch secures him. The best and largest trouts are found to bite thus in the night; and they rise mostly in the still and clear deeps, not in the swift and shallow currents. Sometimes, though there are fish about the place, they will not rise at the bait: in this case the angler must put on some lead to his line, and sink it to the bottom.

*Night-Mare*, or *Incubus*. See Medicine, N° 329.

*Night-Walkers*, in medicine. See Medicine, N° 329, and Noctambuli.

*Night-Walkers*, in law, are such persons as sleep by day and walk by night, being oftentimes pilferers or disturbers of the public peace. Constables are authorized by the common law to arrest night-walkers and suspicious persons, &c. Watchmen may also arrest night-walkers, and hold them until the morning: and it is said, that a private person may arrest any suspicious night-walker, and detain him till he give a good account of himself. One may be bound to the good behaviour for being a night-walker; and common night-walkers, or haunters of bawdy-houses, are to be indicted before justices of peace, &c. But it is not held lawful for a constable, &c. to take up any woman as a night-walker on bare suspicion only of being of ill fame, unless she be guilty of a breach of the peace, or some unlawful act, and ought to be found misdoing.

NIGHTINGALE, in ornithology; a species of motacilla. See Motacilla, and Plate CCCXV.

The nightingale takes its name from *night*, and the Saxon word *galan*, "to sing;" expressive of the time of its melody. Its size and colour has been described already under Motacilla: to which account we add, that its eyes are remarkably large and piercing; and though it is about equal in size to the redstart, it is longer in body, and more elegantly made.

Mr Hunter found, by dissection, that the muscles of the larynx are stronger in the nightingale than in any other bird of the same size.—Sibbald places them in his list of Scotch birds; but they certainly are unknown in that part of Great Britain, probably from the scarcity and the recent introduction of hedges there. Yet they visit Sweden, a much more severe climate. In England they frequent thick hedges, and low coppices; and generally keep in the middle of the bush, so that they are very rarely seen. When the young ones first come abroad, and are helpless, the old birds make a plaintive and jarring noise with a sort of

Nightingale. of snapping as if in menace, pursuing along the hedge the passengers.

They begin their song in the evening, and continue it the whole night. These their vigils did not pass unnoticed by the ancients: the slumbers of these birds were proverbial; and not to rest as much as the nightingale, expressed a very bad sleeper (A). This was the favourite bird of the British poet, who omits no opportunity of introducing it, and almost constantly noting its love of solitude and night. How finely does it serve to compose part of the solemn scenery of his *Penseroso;* when he describes it

> In her saddest sweetest plight,
> Smoothing the rugged brow of night;
> While *Cynthia* checks her dragon yoke,
> Gently o'er th' accustom'd oak.
> Sweet bird, that shunn'st the noise of folly,
> Most musical, most melancholy!
> Thee, chauntress, oft' the woods among,
> I woo to hear thy evening song.

In another place he styles it the *solemn bird;* and again speaks of it,

> As the wakeful bird
> Sings darkling, and, in shadiest covert hid,
> Tunes her nocturnal note.

The reader will excuse a few more quotations from the same poet, on the same subject; the first describes the approach of evening, and the retiring of all animals to their repose.

> Silence accompanied; for beast and bird,
> They to their grassy couch, these to their nests,
> Were slunk; all but the wakeful *nightingale,*
> She all night long her am'rous descant sung.

When Eve passed the irksome night preceding her fall, she, in a dream, imagines herself thus reproached with losing the beauties of the night by indulging too long a repose.

> Why sleep'st thou, *Eve?* now is the pleasant time,
> The cool, the silent, save where silence yields
> To the night warbling bird, that now awake
> Tunes sweetest his love labour'd song.

The same birds sing their nuptial song, and lull them to rest. How rapturous are the following lines! how expressive of the delicate sensibility of our Milton's tender ideas?

> The earth
> Gave sign of gratulation, and each hill;
> Joyous the birds; fresh gales and gentle airs
> Whisper'd it to the woods, and from their wings
> Flung rose, flung odours from the spicy shrub,
> Disporting, till the am'rous bird of night
> Sung spousal, and bid haste the evening star
> On his hill top to light the bridal lamp.
> These, lull'd by *nightingales,* embracing slept;
> And on their naked limbs the flow'ry roof
> Shower'd roses, which the morn repair'd.

These quotations from the best judge of melody, we thought due to the sweetest of our feathered choiristers; and we believe no reader of taste will think them tedious.

Virgil seems to be the only poet among the ancients who hath attended to the circumstance of this bird's singing in the night time.

> *Qualis populeâ mærens* Philomela *sub umbrâ*
> *Amissos queritur fœtus, quos durus arator*
> *Observans nido implumes detraxit: at illa*
> *Flet noctem, ramoque sedens miserabile carmen*
> *Integrat, et mœstis late loca questibus implet.*
> Georg. IV. l. 511.

> As *Philomel* in poplar shades, alone,
> For her lost offspring pours a mother's moan,
> Which some rough ploughman marking for his prey,
> From the warm nest, unfledg'd, hath dragg'd away;
> Perch'd on a bough, she all night long complains,
> And fills the grove with sad repeated strains.
> *F. Warton.*

Pliny has described the warbling notes of this bird with an elegance that bespeaks an exquisite sensibility of taste. Lib. X. c. 29.

If the nightingale is kept in a cage, it often begins to sing about the latter end of November, and continues its song more or less till June.—A young Canary bird, linnet, sky lark, or robin (who have never heard any other bird), are said best to learn the note of a nightingale.

*Mock* Nightingale. See Motacilla, sp. 8.

*Virginian* Nightingale, in ornithology, the common, but improper, name of a bird of the grosbeaked kind, called by authors the *coccothraustes Indica cristata.*

It is a little smaller than our blackbird; it has a black ring surrounding the eyes and nostrils; the beak is very large and thick, but not altogether so large as in the common gross-beak; and its head is ornamented with a very high and beautiful crest, which it moves about very frequently; it is all over of a very fine and lively red, but paler on the head and tail than elsewhere; it is brought to us from Virginia, and is much valued in England for its beauty and delicate manner of singing; it is very fond of almonds and the like fruits.

NIGHTSHADE, in botany. See Solanum.

*Deadly* Nightshade. See Atropa.—The berries of this plant are of a malignant poisonous nature; and, being of a sweet taste, have frequently proved destructive to children. A large glass of warm vinegar, taken as soon as possible after eating the berries, will prevent their bad effects.

Nigidius. NIGIDIUS figulus (Publius), one of the most learned men of ancient Rome, flourished at the same time with Cicero. He wrote on various subjects; but his pieces appeared so refined and difficult that they were not regarded. He assisted Cicero, with great prudence, in defeating Catiline's conspiracy, and did him many services in the time of his adversity. He

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(A) *Ælian var. hist.* 577. both in the text and note. It must be remarked, that nightingales sing also in the day.

adhered to Pompey in opposition to Cæsar; which occasioned his exile, he dying in banishment. Cicero, who had always entertained the highest esteem for him, wrote a beautiful consolatary letter to him (the 13th of *Lib.* IV. *ad Familiares.*)

NIGRINA, in botany; a genus of the monogynia order, belonging to the petandria class of plants. The corolla is funel-shaped; the calyx inflated; the stigma obtuse; the capsule bilocular.

NIGRITIA. See NEGROLAND.

NIGUA. See. CHEGOE.

NILE, a large and celebrated river of Africa, to which the country of Egypt owes its fertility; and the exploring the sources of which has, from the remotest ages, been accounted an impracticable undertaking. Of late this problem has been solved by James Bruce, Esq; of Kinnaird, in Scotland; who spent several years at the court of Abyssinia, and by the favour of the emperor and great people of the country was enabled to accomplish the arduous task.

In the account of his travels lately published, this gentleman has been at particular pains to show, that none of those who undertook this task ever succeeded in it but himself. The inquiry concerning its springs, he says, began either before history or tradition, and is by some supposed to be the origin of hieroglyphics. Though Egypt was the country which received the greatest benefit from this river, it was not there that the inquiries concerning its inundation began: it being probable that every thing relative to the extent and periodical time of that inundation could be accurately settled (which could not be done but by a long series of observations) before any person would venture to build houses within its reach.

The philosophers of Meroe, in our author's opinion, were the first who undertook to make a number of observations sufficient to determine these points; their country being so situated, that they could perceive every thing relative to the increase or decrease of the river without any danger from its overflowing. Being much addicted to astronomy, it could not long escape them, that the heliacal rising of the dog star was a signal for Egypt to prepare for the inundation; without which it was vain to expect any crop. The conection of this celestial sign with the annual rising of the river would undoubtedly soon become a matter of curiosity; and as this could not easily be discovered, it was natural for an ignorant and superstitious people to ascribe the whole to the action of the dog star as a deity. Still however, by those who were more enlightened, the phenomenon would be ascribed to natural causes; and a great step towards the discovery of these, undoubtedly was that of the sources of the river itself. In the early ages, when travelling into foreign countries was impracticable by private persons, the inquiry into the sources of the Nile became an object to the greatest monarchs. Sesostris is said to have preferred the honour of discovering them almost to all the victories he obtained. Alexander the Great is well known to have had a great curiosity to discover these fountains. On his arrival at the temple of Jupiter Ammon, he is said to have made inquiry concerning the fountains of the Nile, even before he asked about his own descent from Jupiter. The priests are said to have given him proper directions for finding them: and Alexander took the most ready means of accomplishing his purpose, by employing natives of Ethiopia to make the search. These discoverers, in the opinion of Mr Bruce, missed their aim, by reason of the turn which the Nile takes to the east in the latitude of 9° where it begins to surround the kingdom of Gojam; but which they might imagine to be only a winding of the river soon to be compensated by an equal turn to the west. "They therefore (says he) continued their journey south till near the line, and never saw it more; as they could have no possible notion it had turned back behind them, and that they had left it as far north as latitude 9°. They reported then to Alexander what was truth, that they had ascended the Nile as far south as latitude 9°; where it unexpectedly took its course to the east, and was seen no more. The river was not known, nor to be heard of near the line, or farther southward, nor was it diminished in size, nor had it given any symptom that the were near its source; they had found the Nile *calentem* (warm), while they expected its rise among melting snows.

Mr Bruce is of opinion that this turn of the Nile to the eastward was the occasion of Alexander's extravagant mistake, in supposing that he had discovered the fountains of the Nile when he was near the source of the Indus; and which he wrote to his mother, though he afterwards caused it to be erased from his books.

Ptolemy Philadelphus succeeded Alexander in his attempts to discover the source of the Nile; but he likewise proving unsuccessful, the task was not undertaken by Ptolemy Euergetes, the most powerful of the Greek princes who sat on the throne of Egypt. "In this (says Mr Bruce) he had probably succeeded, had he not mistaken the river itself. He supposed the Siris, now the Tacazze, to be the Nile; and ascending in the direction of its stream, he came to Axum, the capital of Sira and of Ethiopia. But the story he tells of the snow which he found knee-deep on the mountains of Samen, makes me question whether he ever crossed the Siris, or was himself an ocular witness of what he says he observed there."

Cæsar had the same curiosity with other conquerors to visit the springs of the Nile, though his situation did not allow him to make any attempt for that purpose. Nero, however, was more active. He sent two centurions into Ethiopia, with orders to explore the unknown fountains of this river; but they returned without having accomplished their errand. They reported, that, after having gone a long way, they came to a king of Ethiopia, who furnished them with necessaries, and recommendations to some other kingdoms adjacent; passing which, they came to immense lakes, of which nobody knew the end, nor could they ever hope to find it. Their story, however, is by Mr Bruce supposed to be a fiction; as the Nile forms no lakes throughout its course, excepting that of Tzana or Dembea, the limits of which are easily perceived.

No other attempt was made by the ancients to discover the sources of this celebrated river; and the matter was looked upon to be an impossibility, insomuch that *caput Nili quærere* became a proverb, denoting the impossibility of any undertaking. The first who, in more modern ages, made any attempt of this

kind

Nile. kind was a monk sent into Abyssinia in the year 522, by Nonnosus, ambassador from the emperor Justin. This monk is called *Cosmas the Hermit*, and likewise *Indoplaustes*, from his supposed travels into India. He proceeded as far as the city of Axum, but did not visit that part of the country where the head of the Nile lies; nor, in Mr Bruce's opinion, would it have been practicable for him to do so. The discovery, however, is said to have been made at last by Peter Paez the missionary. But the truth of this account is denied by Mr Bruce, for the following reasons: 1. "No relation of this kind (says he) was to be found in three copies of Peter Paez's history, to which I had access when in Italy, on my return home. One of these copies I saw at Milan; and, by the interest of friends, had an opportunity of perusing it at my leisure. The other two were at Bologna and Rome. I ran through them rapidly; attending only to the place where the description ought to have been, and where I did not find it: but having copied the first and last page of the Milan manuscript, and comparing them with the two last mentioned, I found that all the three were, word for word, the same, and none of them contained one syllable of the discovery of the source. 2. Alphonso Mendez came into Abyssinia about a year after Paez's death. New and desirable as that discovery must have been to himself, to the pope, king of Spain, and all his great patrons in Portugal and Italy; though he wrote the history of the country, and of the particulars concerning the mission in great detail and with good judgment, yet he never mentions this journey of Peter Paez, though it probably must have been conveyed to Rome and Portugal after his inspection and under his authority. 3. Balthazar Tellez, a learned Jesuit, has wrote two volumes in folio, with great candour and impartiality, considering the spirit of those times; and he declares his work to be compiled from those of Alphonso Mendez the patriarch, from the two volumes of Peter Paez, as well as from the regular reports made by the individuals of the company in some places, and by the provincial letters in others; to all which he had complete access, as also to the annual reports of Peter Paez, among the rest from 1598 to 1622; yet Tellez makes no mention of such a discovery, though he is very particular as to the merit of each missionary during the long reign of Facilidas, which occupies more than half the two volumes."

The first, and indeed the only account of the fountains of the Nile, published before that of Mr Bruce, was Kircher's; who says that he took it from the writings of Peter Paez. The time when the discovery is laid to have been made was the 21st of April 1618; at which season the rains are begun, and therefore very unwholesome; so that the Abyssinian armies are not without extreme necessity in the field; between September and February at farthest is the time they are abroad from the capital and in action.

"The river (says Kircher) at this day, by the Ethiopians, is called *Abavy*; it rises in the kingdom of Gojam, in a territory called *Sabala*, whose inhabitants are called *Agows*. The source of the Nile is situated in the west part of Gojam, in the highest part of a valley, which resembles a great plain on every side surrounded by high mountains. On the 21st of April 1618 being here, together with the king and his army, I ascended the place, and observed every thing with great attention: I discovered first two round fountains each about four palms in diameter, and saw, with the greatest delight, what neither Cyrus the Persian, nor Cambyses, nor Alexander the Great, nor the famous Julius Cæsar, could ever discover. The two openings of these fountains have no issue in the plain on the top of the mountain, but flow from the root it. The second fountain lies about a stone-cast west from the former: the inhabitants say that this whole mountain is full of water; and add, that the whole plain about the fountain is floating and unsteady, a certain mark that there is water concealed under it; for which reason the water does not overflow at the fountain, but forces itself with great violence out at the foot of the mountain. The inhabitants together with the emperor, who was then present with his army, maintain, that that year it trembled very little on account of the drought; but in other years, that it trembled and overflowed so that it could scarce be approached without danger. The breadth of the circumference may be about the cast of a sling: below the top of this mountain the people live about a league distant from the fountain to the west; and this place is called *Geesh*; and the fountain seems to be about a cannon shot distant from Geesh; moreover the field where the fountain is, is on all sides difficult of access, except on the north side, where it may be ascended with ease."

On this relation Mr Bruce observes, that there is no such place as *Sabala*; it ought to have been named *Sacala*, signifying the highest ridge of land, where the water falls equally down on both sides, from east and west, or from north and south. So the sharp roofs of our houses, where the water runs down equally on the opposite sides, are called by the same name. Other objections are drawn from the situation of places, and from the number and situation of the fountains themselves, every one of which Mr Bruce found by actual mensuration to be different from Kircher's account. The following, however, he looks upon to be decisive that Paez never was on the spot. "He says, the field in which the fountains of the Nile are, is of very difficult access; the ascent to it being very steep, excepting on the north, where it is plain and easy. Now, if we look at the beginning of this description, we should think it would be the descent, not the ascent, that would be troublesome; for the fountains were placed in a valley, and people rather *descend* into valleys than *ascend* into them; but supposing it was a valley in which there was a field upon which there was a mountain, and on the mountain these fountains; still, I say, that these mountains are nearly inaccessible on the three sides; but that the most difficult of them all is the north, the way we ascend from the plain of Goutto. From the east, by Sacala, the ascent is made from the valley of Litchambara, and from the plain of Assoa to the south you have the almost perpendicular craggy cliff of Geesh, covered with thorny bushes, trees, and bamboos, which cover the mouths of the caverns; and on the north you have the mountains of Asormasha, thick set with all sorts of thorny trees and shrubs, especially with the kantussa: these thickets are more-

over, filled with wild beasts, especially huge, long-haired baboons, which we frequently met walking upright. Through these high and difficult mountains we have only narrow paths, like those of sheep, made by the goats, or the wild beasts we are speaking of, which, after we had walked on them for a long space, landed us frequently at the edge of some valley or precipice, and forced us to go back again to seek a new road. From towards Zeegam to the westward, and from the plain where the river winds so much, is the only easy access to the fountains of the Nile: and they that ascend to them by this way will not even think that approach too easy."

Peter Heiling, a Protestant of Lubec, resided several years in the country of Gojam, and was even governor of it, but he never made any attempt to discover the source of the Nile; dedicating himself entirely to a studious and solitary life. The most extraordinary attempt, however, that ever was made to discover the source of this or any other river, was that of a German nobleman named *Peter Joseph de Roux*, comte de Desreval. He had been in the Danish navy from the year 1721; and, in 1739, was made rear-admiral. That same year he resigned his commission, and began his attempt to discover the source of the Nile in Egypt. To this country he took his wife along with him; and had no sooner reached Cairo, than he quarrelled with a Turkish mob on a point of etiquette; which instantly brought upon them the janizaries and guards of police, to take them into custody. The countess exerted herself in an extraordinary manner; and armed only with a pair of scissars, put all the janizaries to flight, and even wounded several of them; so that her husband was left at liberty to pursue his plan of discovery. To accomplish this, he provided a barge with small cannon, and furnished with all necessary provisions for himself and his wife, who was still to accompany him. Before he set out, however, it was suggested to him, that, supposing government might protect him so far as to allow his barge to pass the confines of Egypt safely, and to the first cataract; supposing also that she was arrived at Ibrim, or Deir, the last garrisons depending on Cairo; yet still some days journey above the garrisons of Deir and Ibrim began the dreadful deserts of Nubia; and farther south, at the great cataract of Jan Adel, the Nile falls 20 feet down a perpendicular rock—so that here his voyage must undoubtedly end. The count, however, flattered himself with being able to obtain such assistance from the garrisons of Ibrim and Deir as would enable him to take the vessel to pieces, and to carry it above the cataract, where it could again be launched into the river. To facilitate this scheme he had even entered into a treaty with some of the barbarians named *Kennouss*, who reside near the cataract, and employ themselves in gathering sena, which abounds in their country. These promised to assist him in this extraordinary adventure; but, luckily for the count, he suffered himself at last to be persuaded by some Venetian merchants at Cairo not to proceed in person on such a dangerous and unheard of navigation, but rather to depute Mr Norden, his lieutenant, who was likewise to serve as his draughtsman, to recoinnoitre the forts of Ibrim and Deir, as well as the cataract of Jan Adel, and renew his treaty with the Kennouss. This gentleman accordingly embarked upon one of the vessels common on the Nile, but met with a great many difficulties and disasters before he could reach Syene and the first cataract; after which having with still greater difficulty reached Ibrim, instead of meeting with any encouragement for the count to proceed on his voyage, he was robbed of all he had by the governor of the fort, and narrowly escaped with his life; it having been for some time determined by him and his soldiers, that Mr Norden should be put to death. By these difficulties the count was so much disheartened, that he determined to make no more attempts on the Nubian side. He now resolved to enter Abyssinia by the island of Masuah. With this view he undertook a voyage round the Cape of Good Hope, in order to reach the Red sea by the straits of Babelmandel: but having begun to use his Spanish commission, and taken two English ships, he was met by Commodore Barnet, who made prizes of all the vessels he had with him, and sent home the count himself passenger in a Portuguese ship to Lisbon.

Thus Mr Bruce considers himself as the first European who reached the sources of this river. He informs us that they are in the country of the Agows, as Kircher had said; so that the latter must either have visited them himself, or have had very good information concerning them. The name of the place through which is the passage to the territory of the Agows, is *Abala*; a plain or rather valley, generally about half a mile, and never exceeding a whole mile, in breadth. The mountains which surround it are at first of an inconsiderable height, covered to the very top with herbage and acacia trees; but as they proceed to the southward they become more rugged and woody.—On the top of these mountains are delightful plains, producing excellent pasture. Those to the west join a mountain called *Aformaska*, where, from a direction nearly south-east, they turn south, and enclose the villages and territory of Sacala, which lie at the foot of them; and still lower, that is, more to the westward, is the small village of Geesh, where the fountains of the Nile are situated. Here the mountains are in the form of a crescent; and along these the river takes its course. Those which enclose the east side of the plain run parallel to the former in their whole course, making part of the mountains of Lechtambara, or at least joining with them, and these two, when behind Aformaska, turn to the south, and then to the south-west, taking the same form as they do; only making a greater curve, and enclosing them likewise in the form of a crescent, the extremity of which terminates immediately above a small lake named *Gooderoo* in the plain of Assoa, below Geesh, and directly at the fountains of the Nile.

Having passed several considerable streams, all of which empty themselves into the Nile, our traveller found himself at last obliged to ascend a very steep and rugged mountain, where no other path was to be found but a very narrow one made by the sheep or goats, and which in some places was broken, and full of holes; in others, he was obstructed with large stones, which seemed to have remained there since the creation. The whole was covered with thick wood; and he was everywhere stopped by the kantuffa, as well as by several other thorny plants

plants, almost as troublesome as that. Having at last, however, reached the top, he had a sight of the Nile immediately below him; but so diminished in size, that it now appeared only a brook scarce sufficient to turn a mill. The village of Geesh is not within sight of the fountains of the river, though not more than 600 yards distant from them. The country about that place terminates in a cliff of about 300 yards high, which reaches down to the plain of Assoa, continuing in the same degree of elevation till it meets the Nile again about 17 miles to the southward, after having made the circuit of the provinces of Gojam and Damot. In the middle of this cliff is a vast cave running straight northward, with many by paths forming a natural labyrinth, of sufficient bigness to contain the inhabitants of the whole village with their cattle. Into this Mr Bruce advanced about 100 yards; but he did not choose to go farther, as the candle he carried with him seemed ready to go out; and the people assured him that there was nothing remarkable to be seen at the end. The face of this cliff, fronting the south, affords a very picturesque view from the plain of Assoa below; parts of the houses appearing at every stage through the bushes and thickets of trees. The mouths of the cavern above mentioned, as well as of several others which Mr Bruce did not see, are hid by almost impenetrable fences of the worst kind of thorn; nor is there any other communication betwixt the upper part and the houses but by narrow winding sheep paths, very difficult to be discovered; all of them being allowed to be overgrown, as a part of the natural defence of the people. The edge of the cliff is covered with lofty and high trees, which seem to form a natural fence to prevent people from falling down: and the beauty of the flowers which the Abyssinian thorns bear, seems to make some amends for their bad qualities. From the edge of the cliff of Geesh, above where the village is situated, the ground slopes with a descent due north, till we come to a triangular marsh upwards of 86 yards broad, and 286 from the edge of the cliff, and from a priest's house where Mr Bruce resided. On the east, the ground descends with a very gentle slope from the large village of Sacala, which gives its name to the territory, and is about six miles distant from the source, though to appearance not above two. About the middle of this marsh, and not quite 40 yards from the foot of the mountain of Geesh, rises a circular hillock about three feet from the surface of the marsh itself, though founded apparently much deeper in it. The diameter of this hillock is not quite 12 feet, and it is surrounded by a shallow trench which collects the water, and sends it off to the eastward. This is firmly built of sod brought from the sides, and kept constantly in repair by the Agows, who worship the river, and perform their religious ceremonies upon this as an altar. In the midst of it is a circular hole, in the formation or enlargement of which the work of art is evidently discernible. It is always kept clear of grass and aquatic plants, and the water in it is perfectly pure and limpid, but without any ebullition or motion discernible on its surface. The mouth is some parts of an inch less than three feet diameter, and at the time our author first visited it (Nov. 5. 1770), the water stood about two inches from the brim, nor did it either increase or diminish during all the time of his residence at Geesh. On putting down the shaft of a lance, he found a very feeble resistance at six feet four inches, as if from weak rushes and grass; and, about six inches deeper, he found his lance had entered into soft earth, but met with no obstruction from stones or gravel: and the same was confirmed by using a heavy plummet, with a line besmeared with soap.—This is the first fountain of the Nile.

The second fountain is situated at about ten feet distant from the former, a little to the west of south; and is only 11 inches in diameter, but eight feet three inches deep. The third is about 20 feet SSW from the first; the mouth being somewhat more than two feet in diameter, and five feet eight inches in depth. These fountains are made use of as altars, and from the foot of each issues a brisk running rill, which, uniting with the water of the first trench, goes off at the east side in a stream which, our author conjectures, would fill a pipe about two inches diameter. The water of these fountains is extremely light and good, and intensely cold, though exposed to the scorching heat of the sun, without any shelter; there being no trees nearer than the cliff of Geesh. The longitude of the principal fountain was found by Mr Bruce to be 36° 55′ 30″ E. from Greenwich. The elevation of the ground, according to his account, must be very great, as the barometer stood only at 22 English inches. "Neither (says he) did it vary sensibly from that height any of the following days I staid at Geesh; and thence I inferred, that at the sources of the Nile I was then more then two miles above the level of the sea; a prodigious height, to enjoy a sky perpetually clear, as also a hot sun never overcast for a moment with clouds from rising to setting." In the morning of Nov. 6. the thermometer stood at 44°, at noon 96°, and at sunset 46°. It was sensibly cold at night, and still more so about an hour before sunrise.

The Nile thus formed by the union of streams from these three fountains, runs eastward through the marsh for about 30 yards, with very little increase of its water, but still distinctly visible, till it is met by the grassy brink of the land descending from Sacala. By this it is turned gradually NE, and then due north; and in the two miles in which it flows in that direction it receives many small streams from springs on each side; so that about this distance from the fountains it becomes a stream capable of turning a common mill. Our traveller was much taken with the beauty of this spot. "The small rising hills about us (says he) were all thick covered with verdure, especially with clover the largest and finest I ever saw; the tops of the heights covered with trees of a prodigious size: the stream, at the banks of which we were sitting, was limpid, and pure as the finest crystal; the sod covered thick with a kind of bushy tree, that seemed to affect to grow to no height, but, thick with foliage and young branches, rather to assist the surface of the water; whilst it bore, in prodigious quantities, a beautiful yellow flower, not unlike a single rose of that colour, but without thorns; and indeed, upon examination, we found that it was not a species of the rose, but of the hypericum."

Here Mr Bruce exults greatly in his success; as

Nile. having not only seen the fountains of the Nile, but the river itself running in a small stream; so that the ancient saying of the poet,

*Nec licuit populis parvum te Nile videre,*

could not be applied to him. Here he *stepped* over it, he says, more than 50 times, though he had told us, in the preceding page, that it was *three yards* over. From this ford, however, the Nile turns to the westward; and, after running over loose stones occasionally in that direction about four miles farther, there is a small cataract of about six feet in height; after which it leaves the mountainous country, and takes its course through the plains of Goutto. Here it flows so gently that its motion is scarcely to be perceived, but turns and winds in its direction more than any river he ever saw; forming more than 20 sharp angular peninsulas in the space of five miles. Here the soil is composed of a marshy clay, quite destitute of trees, and very difficult to travel through; and where its stream receives no considerable addition. Issuing out from thence, however, it is joined by several rivulets which fall from the mountains on each side, so that it becomes a considerable stream, with high and broken banks covered with old timber trees for three miles. In its course it inclines to the north-east, and winds very much, till it receives first a small river named *Diwa*, and then another named *Dee-ohha*, or the river Dee. Turning then sharply to the east, it falls down another cataract, and about three miles below receives the Jemma, a pure and limpid stream, not inferior in size to itself. Proceeding still to the northward, it receives a number of other streams, and at last crosses the southern part of the lake Tzana or Dembea, preserving the colour of its stream during its passage, and issuing out at the west side of it in the territory of Dara.

There is a ford, though very deep and dangerous, at the place where the Nile first assumes the name of a river, after emerging from the lake Dembea: but the stream in other places is exceedingly rapid: the banks in the course of a few miles become very high, and are covered with the most beautiful and variegated verdure that can be conceived. It is now confined by the mountains of Begemder till it reaches Alata, where is the third cataract. This, we are informed by Mr Bruce, is the most magnificent sight he ever beheld; but he thinks that the height has rather been exaggerated by the missionaries, who make it 50 feet; and after many attempts to measure it, he is of opinion that it is nearly 40 feet high. At the time he visited it, the river had been pretty much swelled by rains, and fell in one sheet of water, without any interval, for the space of half an English mile in breadth, with such a noise as stunned and made him giddy for some time. The river, for some space both above and below the fall, was covered with a thick mist, owing to the small particles of the water dashed up into the air by the violence of the shock. The river, though swelled beyond its usual size, retained its clearness, and fell into a natural bason of rock; the stream appearing to run back against the foot of the precipice over which it falls with great violence; forming innumerable eddies, waves, and being in excessive commotion, as may easily be imagined. Jerome Lobo pretends that he was able to reach the foot of the rock, and sit under the prodigious arch of water spouting over it; but Mr Bruce does not hesitate to pronounce this to be an absolute falsehood. The noise of the cataract, which, he says, is like the loudest thunder, could not but confound and destroy his sense of hearing; while the rapid motion of the water before his eyes would dazzle the sight, make him giddy, and utterly deprive him of all of his intellectual powers. "It was a most magnificent sight (says Mr Bruce), that ages, added to the greatest length of human life, would not deface or eradicate from my memory: it struck me with a kind of stupor, and a total oblivion of where I was, and of every other sublunary concern." Nile.

About half a mile below the cataract, the Nile is confined between two rocks, where it runs in a narrow channel with impetuous velocity and great noise. At the village of Alata there is a bridge over it, consisting of one arch, and that no more than 25 feet wide. This bridge is strongly fixed into the solid rock on both sides, and some part of the parapets still remain. No crocodiles ever come to Alata, nor are any ever seen beyond the cataract.

Below this tremendous water-fall the Nile takes a south-east direction, along the western side of Begemder and Amhara on the right, enclosing the province of Gojam. It receives a great number of streams from both sides, and after several turns takes at last a direction almost due north, and approaches within 62 miles of its source. Notwithstanding the vast increase of its waters, however, it is still fordable at some seasons of the year; and the Galla cross it at all times without any difficulty, either by swimming, or on goats-skins blown up like bladders. It is likewise crossed on small rafts, placed on two skins filled with wind; or by twisting their hands round the tails of the horses who swim over; a method always used by the women who follow the Abyssinian armies, and are obliged to cross unfordable rivers. In this part of the river crocodiles are met with in great numbers; but the superstitious people pretend they have charms sufficiently powerful to defend themselves against their voracity.—The Nile now seems to have forced its passage through a gap in some very high mountains which bound the country of the Ganges, and falls down a cataract of 280 feet high; and immediately below this are two others, both of very considerable height. These mountains run a great way to the westward, where they are called *Dyre* or *Tegla*, the eastern end of them joining the mountains of Kueira, where they have the name of *Fazuclo*. These mountains, our author informs us, are all inhabited by Pagan nations; but the country is less known than any other on the African continent. There is plenty of gold washed down from the mountains by the torrents in the rainy season; which is the fine gold of Sennaar named *Tibbar*.

The Nile, now running close by Sennaar in a direction nearly north and south, makes afterwards a sharp turn to the east; affording a pleasant view in the fair season, when it is brim-full, and indeed the only ornament of that bare and inhospitable country. Leaving Sennaar, it passes by many large towns inhabited by Arabs, all of them of a white complexion; then passing Gerri, and turning to the north-east, it joins the Tacazze, passing, during its course through this country,

 try a large and populous town named *Chendi*, probably the Candace of the ancients. Here Mr Bruce supposes the ancient island or peninsula of Meroe to have been situated. Having at length received the great river Atbara, the Astaboras of the ancients, it turns directly north for about two degrees; then making a very unexpected turn west by south for more than two degrees in longitude, and winding very little, it arrives at Korti, the first town in Barabra, or kingdom of Dongola. From Korti it runs almost southwest till it passes Dongola, called also *Beja*, the capital of Barabra; after which it comes to Moscho, a considerable town and place of refreshment to the caravans when they were allowed to pass from Egypt to Ethiopia. From thence turning to the north-east it meets with a chain of mountains in about 22° 15′ of N. latitude, where is the seventh cataract named *Jan Adel*. This is likewise very tremendous, though not above half as high as that of Alata. This course is now continued till it falls into the Mediterranean; there being only one other cataract in the whole space, which is much inferior to any of those already described.

This very particular and elaborate account of the sources of the Nile and of the course of the river given by Mr Bruce, hath not escaped criticism. We find him accused by the reviewers, not only of having brought nothing to light that was not previously known to the learned, but even of having revealed nothing which was not previously published in Guthrie's Geographical Grammar. This, however, seems by no means a fair and candid criticism. If the sources of the Nile, as described by Mr Bruce, were known to the author of Guthrie's Grammar, they must likewise have been so to every retailer of geography since the time of the millionaire; which, as the reviewers have particularized that book, would not seem to have been the case. If any thing new was published there previous to the appearance of Mr Bruce's work, it must probably have been derived indirectly from himself; of which clandestine method of proceeding that gentleman has had frequent occasion to complain in other cases. It is alleged, however, that he has given the name of *Nile* to a stream which does not deserve it. This, like all other large rivers, is composed of innumerable branches; to visit the top of every one of which would be indeed an Herculean task. The source of the largest branch therefore, and that which has the longest course, is undoubtedly to be accounted the source of the river; but here it is denied that Mr Bruce had sufficient information. "Of the innumerable streams (say they) that feed the lake of Tzana, there is one that ends in a bog, to which Mr Bruce was conducted by Woldo, a lying guide, who told him it was the source of the Nile. Mr Bruce, in a matter of far less importance, would not have taken Woldo's word; but he is persuaded, that in this case he spoke truth; because the credulous barbarians of the neighbouring district paid something like worship to this brook, which, at the distance of 14 miles from its source, is not 20 feet broad, and nowhere one foot deep. Now it is almost unnecessary to observe, that the natives of that country being, according to Mr Bruce's report, pagans, might be expected to worship the pure and salutary stream; to which, with other extraordinary qualities, their superstition ascribed the power of curing the bite of a mad dog. Had he traced to its source any of the other rivulets which run into the lake Tzana, it is not unlikely that he might have met with similar instances of credulity among the ignorant inhabitants of its banks. Yet this would not prove any one of them in particular to be the head of the Nile. It would be trifling with the patience of our readers to say one word more on the question, whether the Portuguese Jesuits or Mr Bruce discovered what they erroneously call the head of the Nile. Before either they or he had indulged themselves in a vain triumph over the labours of antiquity, they ought to have been sure that they had effected what antiquity was unable to accomplish. Now the river described by the Jesuit Kircher, who collected the information of his brethren, as well as by Mr Bruce, is not the Nile of which the ancients were in quest. This is amply proved by the prince of modern geographers, the incomparable D'Anville (at least till our own Rennel appeared), in a copious Memoir published in the 26th volume of the Memoirs of the Academy of Belles Lettres, p. 45.—To this learned dissertation we refer our readers; adding only what seems probable from the writings of Diodorus Siculus and Herodotus, that the ancients had two meanings when they spoke of the head or source of the Nile: First, Literally, the head or source of that great western stream now called the *White River*; which contains a much greater weight of waters, and has a much longer course than the river described by the Jesuits and by Mr Bruce: and, 2dly, Metaphorically, the cause of the Nile's inundation.—This cause they had discovered to be the tropical rains, which fall in the extent of 16 degrees on each side of the line; which made the sacristan of Minerva's temple of Sais in Egypt tell that inquisitive traveller Herodotus, that the waters of the Nile run in two opposite directions from its source; the one north into Egypt, the other south into Ethiopia; and the reports of all travellers into Africa serve to explain and confirm this observation. The tropical rains they acknowledge, give rise to the Nile and all its tributary streams which flow northward into the kingdom of Sennaar, as well as to the Zebee, and so many large rivers which flow south into Ethiopia; and then, according to the inclination of the ground, fall into the Indian or Atlantic ocean. Such then, according to the Egyptian priests, is the true and philosophical source of the Nile; a source discovered above 3000 years ago, and not, as Mr Bruce and the Jesuits have supposed, the head of a paltry rivulet, one of the innumerable streams that feed the lake Tzana."

On this severe criticism, however, it is obvious to remark, that if the source of the Nile had been discovered so many years ago, there is not the least probability that the finding of it should have been deemed an impossible undertaking, which it most certainly was, by the ancients.—That the finding out the fountains of the river itself was an object of their inquiry, cannot be doubted; and from the accounts given by Mr Bruce, it appears very evident that none of the ancients had equal success with himself; though indeed the Jesuits, as has already been observed, seem to have a right to dispute it with him. From the correspondence of his accounts with that of the Jesuits, it appears

Nile. appears certain that the most considerable stream which flows into the lake Tzana takes its rise from the fountains at Geesh already described; and that it is the most considerable plainly appears from its stream being visible through the whole breadth of the lake, which is not the case with any of the rest. The preference given to this stream by the Agows, who worship it, seems also an incontestable proof that they look upon it to be the great river which passes through Ethiopia and Egypt; nor will the argument of the reviewers hold good in *supposing* that other streams are worshipped, unless they could prove that they are so. As little can it be any objection or disparagement to Mr Bruce's labours, that he did not discover the sources of the western branch of the Nile called the *White River.* Had he done so, it might next have been objected that he did not visit the springs of the Tacazze, or any other branch. That the origin of the White river was unknown to the ancients may readily be allowed; but so were the fountains of Geesh, as evidently appears from the erroneous position of the sources of the eastern branch of the Nile laid down by Ptolemy. Our traveller, therefore, certainly has the merit, if not of discovering the sources, at least of confirming the accounts which the Jesuits have given of the sources, of the river called the *Nile;* and of which the White river, whether greater or smaller, seems to be accounted only a branch. The superior veneration paid to the eastern branch of this celebrated river will also appear from the variety of names given to it, as well as from the import of these names; of which Mr Bruce gives the following account.

By the Agows it is named *Gzeir, Geesa,* or *Seir;* the first of which term signifies *a god.* It is likewise named *Ab*, father; and has many other names, all of them implying the most profound veneration. Having descended into Gojam it is named *Abay;* which, according to Mr Bruce, signifies the river that suddenly swells and overflows periodically with rain. By the Gongas on the south side of the mountains Dyre and Tagla, it is called *Dahli,* and by those on the north side *Kowass;* both of which names signify a *watching dog,* the *latrator anubis,* or *dog-star.* In the plain country between Fazurlo and Sennaar it is called *Nile* which signifies *blue;* and the Arabs interpret this name by the word *Azergue;* which name it retains till it reaches Halfaia, where it receives the White river.

Formerly the Nile had the name of *Siris*, both before and after it enters Beja, which the Greeks imagined was given to it on account of its black colour during the inundation; but Mr Bruce assures us that the river has no such colour. He affirms, with great probability, that this name in the country of Beja imports the river of the *dog-star*, on whose vertical appearance this river overflows; "and this idolatrous worship (says he) was probably part of the reason of the question the prophet Jeremiah asks: And what hast thou to do in Egypt to drink the water of Seir, or the water profaned by idolatrous rites?" As for the first, it is only the translation of the word *bahar* applied to the Nile. The inhabitants of the Barabra to this day call it *Bahar el Nil*, or the sea of the Nile, in contradistinction to the Red sea, for which they have no other name than *Bahar el Molech*, or the Salt sea. The junction of the three great rivers, the Nile flowing on the west side of Meroe; the Tacazze, which washes the east side, and joins the Nile at Maggiran in N. Lat. 17°; and the Mareb, which falls into this last something above the junction, gives the name of *Triton* to the Nile. Nile.

The name *Ægyptus*, which it has in Homer, and which our author supposes to have been a very ancient name even in Ethiopia, is more difficult to account for. This has been almost universally supposed to be derived from the black colour of the inundation; but Mr Bruce, for the reasons already given, will not admit of this. "Egypt (says he) in the Ethiopic is called *y Gipt*, Agar; and an inhabitant of the country, *Gypt*, for precisely so it is pronounced; which means the country of ditches or canals, drawn from the Nile on both sides at right angles with the river: nothing surely is more obvious than to write *y Gipt*, so pronounced, *Egypt;* and, with its termination *us* or *os*, *Egyptus*. The Nile is also called *Kronides*, Jupiter; and has had several other appellations bestowed upon it by the poets; though these are rather of a transitory nature than to be ranked among the ancient names of the river. By some of the ancient fathers it has been named *Geon;* and by a strange train of miracles they would have it to be one of the rivers of the terrestrial paradise; the same which is said to have encompassed the whole land of Cush or Ethiopia. To effect this, they are obliged to bring the river a great number of miles, not only under the earth, but under the sea also; but such reveries need no refutation.

Under the article Egypt we have so fully explained the cause of the annual inundation of the Nile, that, with regard to the phenomenon itself, nothing farther seems necessary to be added. We shall therefore only extract from Mr Bruce's work what he has said concerning the mode of natural operation by which the tropical rains are produced; which are now universally allowed to be the cause of the annual overflowing of this and other rivers.

According to this gentleman, the air is so much rarefied by the sun during the time that he remains almost stationary over the tropic of Capricorn, that the other winds loaded with vapours rush in upon the land from the Atlantic ocean on the west, the Indian ocean on the east, and the cold Southern ocean beyond the Cape. Thus a great quantity of vapour is gathered, as it were, into a focus; and as the same causes continue to operate during the progress of the sun northward, a vast train of clouds proceed from south to north, which, Mr Bruce informs us, are sometimes extended much farther than at other times. Thus he tells us, that for two years some white dappled clouds were seen at Gondar, on the 7th of January; the sun being then 34° distant from the zenith, and not the least cloudy speck having been seen for several months before. About the first of March, however, it begins to rain at Gondar but only for a few minutes at a time in large drops; the sun being then about 5° distant from the zenith. The rainy season commences with violence at every place when the sun comes directly over it; and before it commences at Gondar, green boughs and leaves appear floating in the Bahar el Abiad, or

Nile.

or White river, which, according to the accounts given by the Galla, our author supposes to take its rise in about 5° north latitude.

The rains therefore precede the sun only about 5°; but they continue and increase after he has passed it. In April all the rivers in the southern parts of Abyssinia begin to swell, and greatly augment the Nile, which is now also farther augmented by the vast quantity of water poured into the lake Tzana. On the first days of May, the sun passes the village of Gerri, which is the limit of the tropical rains; and it is very remarkable, that, though the sun still continues to operate with unabated vigour, all his influence cannot bring the clouds farther northward than this village; the reason of which Mr Bruce, with great reason, supposes, to be the want of mountains to the northward. In confirmation of this opinion, he observes, that the tropical rains stop at the latitude of 14° instead of 16° in the western part of the continent. All this time, however, they continue violent in Abyssinia; and in the beginning of June the rivers are all full, and continue so while the sun remains stationary in the tropic of Cancer.

This excessive rain, which would sweep off the whole soil of Egypt into the sea were it to continue without intermission, begins to abate as the sun turns southward; and on his arrival at the zenith of each place, on his passage towards that quarter, they cease entirely: the reason of which is no less difficult to be discovered than that of their coming on when he arrives at the zenith in his passage northward. Be the reason what it will, however, the fact is certain; and not only so, but the time of the rains ceasing is exact to a single day; insomuch, that on the 25th of September the Nile is generally found to be at its highest at Cairo, and begins to diminish every day after. Immediately after the sun has passed the line, he begins the rainy season to the southward; the rains constantly coming on with violence as he approaches the zenith of each place; but the inundation is now promoted in a different manner, according to the difference of circumstances in the situation of the places. From about 6° S. Lat. a chain of high mountains runs all the way along the middle of the continent towards the Cape of Good Hope, and intersects the southern part of the peninsula nearly in the same manner that the Nile does the northern. A strong wind from the south, stopping the progress of the condensed vapours, dashes them against the cold summits of this ridge of mountains, and forms many rivers, which escape in the direction either of east or west as the level presents itself. If this is towards the west, they fall down the sides of the mountains into the Atlantic, and if on the east into the Indian ocean.—"The clouds (says Mr Bruce), drawn by the violent action of the sun, are condensed, then broken, and fall as rain on the top of this high ridge, and swell every river; while a wind from the ocean on the east blows like a monsoon up each of these streams, in a direction contrary to their current during the whole time of the inundation; and this enables boats to ascend into the western parts of Sofala, and the interior country, to the mountains where lies the gold. The same effect, from the same cause, is produced on the western side towards the Atlantic; the high ridge of mountains being placed between the different countries west and east, is at once the source of their riches, and of those rivers which conduct to the treasures, which would be otherwise inaccessible, in the eastern parts of the kingdoms of Benin, Congo, and Angola.

"There are three remarkable appearances attending the inundation of the Nile. Every morning in Abyssinia is clear, and the sun shines. About nine, a small cloud, not above four feet broad, appears in the east, whirling violently round as if upon an axis; but arrived near the zenith, it first abates its motion, then loses its form, and extends itself greatly, and seems to call up vapours from all the opposite quarters. These clouds having attained nearly the same height, rush against each other with great violence, and put me always in mind of Elisha foretelling rain on Mount Carmel. The air, impelled before the heaviest mass, or swiftest mover, makes an impression of its form on the collection of clouds opposite; and the moment it has taken possession of the space made to receive it, the most violent thunder possible to be conceived instantly follows, with rain: after some hours the sky again clears, with a wind at north: and it is always disagreeably cold when the thermometer is below 63°.

"The second thing remarkable is the variation of the thermometer. When the sun is in the southern tropic, 36° distant from the zenith of Gondar, it is seldom lower than 72°; but it falls to 60°, and 63°, when the sun is immediately vertical; so happily does the approach of rain compensate the heat of a too scorching sun.

The third is that remarkable stop in the extent of the rain northward, when the sun, that has conducted the vapours from the line, and should seem now more than ever to be in the possession of them, is here overruled suddenly; till, on its return to Gerri, again it resumes the absolute command over the rain, and reconducts it to the line, to furnish distant deluges to the southward."

With regard to the Nile itself, it has been said that the quantity of earth brought down by it from Abyssinia is so great, that the whole land of Egypt is produced from it. This question, however, is discussed under the article Egypt, where it is shown that this cannot possibly be the case.—Among other authorities there quoted was that of Mr Volney, who strenuously argues against the opinion of Mr Savary and others, who have maintained that Egypt is the gift of the Nile. Notwithstanding this, however, we find him asserting that the soil of Egypt has undoubtedly been augmented by the Nile: in which case it is not unreasonable to suppose that it has been produced by it altogether.—"The reader (says he) will conclude, doubtless, from what I have said, that writers have flattered themselves too much in supposing they could fix the precise limits of the enlargement and rise of the Delta. But, though I would reject all illusory circumstances, I am far from denying the fact to be well founded; it is too plain from reason, and an examination of the country. The rise of the ground appears to me demonstrated by an observation on which little stress has been laid. In going from Rosetta to Cairo, when the waters are low, as in the month of March, we may remark, as we go up the river, that the shore rises gradually above the water; so that if overflowed



two

two feet at Rosetta, it overflows from three to four at Faoua, and upwards of twelve at Cairo (A). Now by reasoning from this fact, we may deduce the proof of an increase by sediment; for the layer of mud being in proportion to the thickness of the sheets of water by which it is deposited, must be more or less considerable as these are of a greater or less depth; and we have seen that the like gradation is observable from Asouan to the sea.

"On the other hand, the increase of the Delta manifests itself in a striking manner, by the form of Egypt along the Mediterranean. When we consider its figure on the map, we perceive that the country which is in the line of the river, and evidently formed of foreign materials, has assumed a semicircular shape, and that the shores of Arabia and Africa, on each side, have a direction towards the bottom of the Delta; which manifestly discovers that this country was formerly a gulf, that in time has been filled up.

"This accumulation is common to all rivers, and is accounted for in the same manner in all: the rain water and the snow descending from the mountains into the valleys, hurry incessantly along with them the earth they wash away in their descent. The heavier parts, such as pebbles and sands, soon stop, unless forced along by a rapid current. But when the waters meet only with a fine and light earth, they carry away large quantities with the greatest facility. The Nile, meeting with such a kind of earth in Abyssinia and the interior parts of Africa, its waters are loaded and its bed filled with it; nay, it is frequently so embarrassed with this sediment as to be straitened in its course. But when the inundation restores to it its natural energy, it drives the mud that has accumulated toward the sea, at the same that it brings down more for the ensuing season; and this, arrived at its mouth, heaps up, and forms shoals, where the declivity does not allow sufficient action to the current, and where the sea produces an equilibrium of resistance. The stagnation which follows occasions the grosser particles, which till then had floated, to sink; and this takes place more particularly in those places where there is least motion, as towards the shores, till the sides become gradually enriched by the spoils of the upper country and of the Delta itself; for if the Nile takes from Abyssinia to give to the Thebais, it likewise takes from the Thebais to give to the Delta, and from the Delta to carry to the sea. Wherever its waters have a current, it despoils the same territory that it enriches. As we ascend towards Cairo, when the river is low, we may observe the banks worn steep on each side and crumbling in large flakes. The Nile, which undermines them, depriving their light earth of support, it falls into the bed of the river; for when the water is high, the earth imbibes it; and when the sun and drought return, it cracks and moulders away in great flakes, which are hurried along by the Nile."

Thus does Mr Volney argue for the increase of the Delta in the very same manner that others have argued for the production of the whole country of Egypt; an opinion which he is at great pains to refute. Under the article EGYPT, however, it is shown that the Nile does not bring down any quantity of mud sufficient for the purposes assigned; and with regard to the argument drawn from the shallowness of the inundation when near the sea, this does not prove any rise of the land; but as Mr Rennel has judiciously observed in his remarks on the inundation of the Ganges, arises from the nature of the fluid itself. The reason, in short, is this: The surface of the sea is the lowest point to which the waters of every inundation have a tendency; and when they arrive there, they spread themselves over it with more ease than anywhere else, because they meet with less resistance. Their motion, however, by reason of the small declivity, is less swift than that of the waters farther up the river, where the declivity is greater; and consequently the latter being somewhat impeded in their motion, are in some degree accumulated. The surface of the inundation therefore, does not form a perfectly level plain, but one gradually sloping from the interior parts of the country towards the sea; so that at the greatest distance from the ocean the water will always be deepest, even if we should suppose the whole country to be perfectly smooth, and composed of the most solid materials.—This theory is easily understood from observing a quantity of water running along a wooden spout, which is always more shallow at the end of the spout where it runs off than at the other.—With regard to Mr Volney's other arguments, they are without doubt contradictory; for if, as he says, the river takes from Abyssinia to give to the Thebais, from Thebais to give to the Delta, and from Delta to the sea, it undoubtedly follows, that it gives nothing to any part of the land whatever, but that altogether is swept into the Mediterranean sea; which, indeed, some very trifling quantities excepted, is most probably the case.

It has been remarked by Mr Pococke, a very judicious traveller, that, in the beginning of the inundation, the waters of the Nile turn red, and sometimes green; and while they remain of that colour, they are unwholesome. He explains this phenomenon by supposing, that the inundation at first brings away that red or green filth which may be about the lakes where it takes its rise; or about the sources of the small rivers which flow into it, near its principal source; "for, says he, although there is so little water in the Nile when at lowest, that there is hardly any current in many parts of it, yet it cannot be supposed that the water should stagnate in the bed of the Nile so as to become green. Afterwards the water begins to be red and still more turbid, and then it begins to be wholesome."—This circumstance is explained by Mr Bruce in the following manner: The country about Narea and Caffa, where the river Abiad takes its rise, is full of immense marshes, where, during the dry season, the water stagnates, and becomes impregnated with every kind of corrupted matter. These, on the commencement of the rains, overflow into the river Abiad, which takes its rise there. The overflowing of

(A) "It would be curious to ascertain in what proportion it continues up to Asouan. Some Copts, whom I have interrogated on the subject, assured me that it was much higher through all the Said than at Cairo."

of these vast marshes first carried the discoloured water into Egypt; after which follows that of the great lake Tzana, through which the Nile passes; which having been stagnated, and without rain, under a scorching sun for six months, joins its putrid waters to the former. In Abyssinia also, there are very few rivers that run after November, but all of them stand in prodigious pools, which, by the heat of the sun, likewise turn putrid, and on the commencement of the rains throw off their stagnant water into the Nile; but at last, the rains becoming constant, all this putrid matter is carried off, and the sources of the inundation become sweet and wholesome. The river then passing through the kingdom of Sennaar, the soil of which is this red bole, becomes coloured with that earth; and a mixture, along with the moving sands of the deserts, of which it receives a great quantity when raised by the wind, precipitates all the viscous and putrid matters which float in the waters; whence Mr Pococke judiciously observes, that the Nile is not wholesome when the water is clear and green, but when so red and turbid that it stains the water of the Mediterranean.

The rains in Abyssinia, which cease about the 8th of September, generally leave a sickly season in the low country; but the diseases produced by these rains are removed by others which come on about the end of October, and cease about the 8th of November. On these rains depend the latter crops of the Abyssinians; and for these the Agows pray to the river, or the genius or spirit residing in it. In Egypt, however, the effect of them is seldom perceived; but in some years they prove excessive: and it has been observed that the Nile, after it has fallen, has again risen in such a manner as to alarm the whole country. This is said to have happened in the time of Cleopatra, when it was supposed to presage the extinction of the government of the Ptolemies; and in 1737 it was likewise imagined to portend some dreadful calamity.

The quantity of rain, by which all this inundation is occasioned, varies considerably in different years; at least at Gondar, where Mr Bruce had an opportunity of measuring it. In 1770 it amounted to 35¼ inches; but in 1771 it amounted to no less than 41.355 inches from the vernal equinox to the 8th of September.—What our author adds concerning the variation of the rainy months seems totally irreconcilable with what he had before advanced concerning the extreme regularity of the natural causes by which the tropical rains are produced. "In 1770 (says he) August was the rainy month; in 1771, July.—When July is the rainy month, the rains generally cease for some days in the beginning of August, and then a prodigious deal falls in the latter end of that month and first week of September. In other years July and August are the violent rainy months, while June is fair. And lastly, in others, May, June, July, August and the first week of September."—If this is the case, what becomes of the regular attraction of the clouds by the sun as he advances northward; of the coming on of the rains when he arrives at the zenith of any place, in his passage to the tropic of Cancer; and of their ceasing when he comes to the same point in his return southward.

Under the article ETHIOPIA we have mentioned a threat of one of the Abyssinian monarchs, that he would direct the course of the Nile and prevent it from fertilizing the land of Egypt; and it has likewise been related, that considerable progress was made in this undertaking by another emperor. Mr Bruce has bestowed an entire chapter on the subject; and is of opinion, that "there seems to be no doubt that it is possible to diminish or divert the course of the Nile, that it should be insufficient to fertilize the country of Egypt; because the Nile, and all the rivers that run into it, and all the rains that swell these rivers, fall in a country two miles above the level of the sea; therefore it cannot be denied, that there is level enough to divert many of the rivers into the Red sea, or perhaps still easier by turning the course of the river Abiad till it meets the level of the Niger, or pass through the desert into the Mediterranean.——Alphonso Albuquerque is said to have written frequently to the king of Portugal to send him pioneers from Madeira, with people accustomed to level grounds, and prepare them for sugar canes; by whose assistance he meant to turn the Nile into the Red sea. This undertaking, however, if it really had been projected, was never accomplished; nor indeed is there any probability that ever such a mad attempt was proposed. Indeed, though we cannot deny that there is a possibility in nature of accomplishing it, yet the vast difficulty of turning the course of so many large rivers may justly stigmatize it as impracticable; not to mention the obstacles which must naturally be suggested from the apparent inutility of the undertaking, and those which would arise from the opposition of the Egyptians.

It has already been observed in a quotation from the reviewers, that Herodotus was informed by the sacristan or secretary of the treasury of Minerva, that one half of the waters of the Nile run north and the other south. This is also taken notice of by Mr Bruce; who gives the following explanation of it. "The secretary was probably of that country himself, and seems by his observation to have known more of it than all the ancients together. In fact we have seen, that between 13° and 14° north latitude, the Nile, with all its tributary streams, which have their rise and course within the tropical rains, falls down into the flat country (the kingdom of Sennaar), which is more than a mile lower than the high country in Abyssinia; and thence, with a little inclination, it runs into Egypt. Again, In latitude 9°, in the kingdom of Gingiro, the Zebee runs south or south-east, into the Inner Ethiopia, as do also many other rivers, and, as I have heard from the natives of that country empty themselves into a lake, as those on the north side of the line do into the lake Tzana, thence distributing their waters to the east and west. These become the heads of great rivers, that run through the interior countries of Ethiopia (corresponding to the sea coast of Melinda and Momboza) into the Indian ocean; whilst, on the westward, they are the origin of the vast streams that fall into the Atlantic, passing through Benin and Congo, southward of the river Gambia and the Sierra Leona. In short, the periodical rains from the tropic of Capricorn to the line, being in equal quantity with those that fall between the line and the tropic of Cancer, it is plain, that if the land of Ethiopia sloped equally from the line southward and northward, the rains that fall would

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Nile.

go, the one half north and the other half ſouth; but as the ground from 5° north declines all ſouthward, it follows, that the rivers which run to the ſouthward muſt be equal to thoſe that run northward, *plus* the rain that falls in the 5° north latitude, where the ground begins to ſlope to the ſouthward; and there can be little doubt that this is at leaſt one of the reaſons why there are in the ſouthern continent ſo many rivers larger than the Nile, that run both into the Indian and Atlantic oceans."

From this account given to Herodotus, it has been ſuppoſed, by ſome writers on geography, that the Nile divides itſelf into two branches, one of which runs northward into Egypt, and one through the country of the Negroes weſtward into the Atlantic ocean. This opinion was firſt broached by Pliny.—It has been adopted by the Nubian geographer, who urges in ſupport of it, that if the Nile carried down all the rains which fall into it from Abyſſinia, the people of Egypt would not be ſafe in their houſes. But to this Mr Bruce anſwers, that the waſte of water in the burning deſerts through which the Nile paſſes is ſo great, that unleſs it was ſupplied by another ſtream, the White River, equal in magnitude to itſelf, and which, riſing in a country of perpetual rains, is thus always kept full, it never could reach Egypt at all, but would be loſt in the ſands, as is the caſe with many other very conſiderable rivers in Africa. "The rains (ſays he) are collected by the four great rivers in Abyſſinia; the Mareb, the Bowiha, the Tacazze, and the Nile. All theſe principal, and their tributary ſtreams, would, however, be abſorbed, nor be able to paſs the burning deſerts, or find their way into Egypt, were it not for the White River, which having its ſource in a country of almoſt perpetual rains, joins to it a never-failing ſtream equal to the Nile itſelf."

We ſhall conclude this article with ſome account of the Agows who inhabit the country about the ſources of the Nile. Theſe, according to Mr Bruce, are one of the moſt conſiderable nations in Abyſſinia, and can bring into the field about 4000 horſe and a great number of foot; but were once much more powerful than they are now, having been greatly reduced by the invaſions of the Galla. Their province is nowhere more than 60 miles in length, or than 30 in breadth; notwithſtanding which they ſupply the capital and all the neighbouring country with cattle, honey, butter, wax, hides, and a number of other neceſſary articles; whence it has been cuſtomary for the Abyſſinian princes to exact a tribute rather than military ſervice from them. The butter is kept from putrefaction during the long carriage, by mixing it with a ſmall quantity of a root ſomewhat like a carrot, which they call *mormoco*. It is of a yellow colour, and anſwers the purpoſe perfectly well; which in that climate it is very doubtful if ſalt could do. The latter is beſides uſed as money; being circulated inſtead of ſilver coin, and uſed as change for gold. Brides paint their feet, hands, and nails, with this root. A large quantity of the ſeed of the plant was brought into Europe by Mr Bruce.

The Agows carry on a conſiderable trade with the Shangalla and other black ſavages in the neighbourhood; exchanging the produce of their country for gold, ivory, horns of the rhinoceros, and ſome fine cotton. The barbarity and thieviſh diſpoſition of both nations, however, render this trade much inferior to what it might be.

Nile, Nilometer.

In their religion the Agows are groſs idolators, paying divine honours to the Nile, as has already been obſerved. Mr Bruce who lodged in the houſe of the prieſt of the river, had an opportunity of becoming acquainted with many particulars of their devotion. He heard him addreſs a prayer to the Nile, in which he ſtyled it the "Moſt High God, the Saviour of the world. In this prayer he petitioned for ſeaſonable rain, plenty of graſs, and the preſervation of a kind of ſerpents; deprecating thunder very pathetically. The moſt ſublime and lofty titles are given by them to the ſpirit which they ſuppoſe to reſide in the river Nile; calling it everlaſting God, Light of the World, Eye of the World, God of Peace, their Saviour, and Father of the Univerſe.

The Agows are all clothed in hides, which they manufacture in a manner peculiar to themſelves. Theſe hides are made in the form of a ſhirt reaching down to their feet, and tied about the middle with a kind of ſaſh or girdle. The lower part of it reſembles a large double petticoat; one fold of which they turn back over their ſhoulders, faſtening it with a broach or ſkewer acroſs their breaſt before, and the married women carry their children in it behind. The younger ſort generally go naked. The women are marriageable at nine years of age, though they commonly do not marry till eleven; and they continue to bear children till 30, and ſometimes longer. They are generally thin and below the middle ſize, as well as the men. Barrenneſs is quite unknown among them.

The country of the Agows has a very elevated ſituation, and is of courſe ſo temperate that the heat may eaſily be borne, though little more than 10° from the equator. The people, however, are but ſhort lived; which may in part be owing to the oppreſſion they labour under. This, according to Mr Bruce, is exceſſive. "Though their country (ſays he) abounds with all the neceſſaries of life, their taxes, tributes, and ſervices, eſpecially at preſent, are ſo multiplied upon them, whilſt their diſtreſſes of late have been ſo great and frequent, that they are only the manufacturers of the commodities they ſell, to ſatisfy theſe conſtant exorbitant demands, and cannot enjoy any part of their own produce themſelves, but live in penury and miſery ſcarce to be conceived. We ſaw a number of women wrinkled and ſun-burnt ſo as ſcarce to appear human, wandering about under a burning ſun, with one and ſometimes two children upon their backs; gathering the ſeeds of bent graſs to make a kind of bread.

NILOMETER, or NILOSCOPE, an inſtrument uſed among the ancients to meaſure the height of the water of the river Nile in its overflowings.

The word comes from Νειλος Nile (and that from νεα ιλυς "new mud," or as ſome others would have it, from νεω, "I flow," and ιλυς, "mud,") and μετρον, "meaſure." The Greeks more ordinarily call it, Νειλοσκοπειον.

The nilometer is ſaid, by ſeveral Arabian writers, to have been firſt ſet up, for this purpoſe, by Joſeph during his regency in Egypt: the meaſure of it

was

Nilometer.

was 16 cubits, this being the height of the increase of the Nile, which was necessary to the fruitfulness of Egypt.

From the measure of this column, Dr Cumberland * deduces an argument, in order to prove that the Jewish and Egyptian cubit were of the same length.

* *Scripture weights and measures*, p. 18.

In the French king's library is an Arabic treatise on nilometers, entitled *Neil si alnal al Nil*; wherein are described all the overflowings of the Nile, from the first year of the Hegira to the 875th.

Herodotus mentions a column erected in a point of the island Delta, to serve as a nilometer; and there is still one of the same kind in a mosque of the same place.

As all the riches of Egypt arise from the inundations of the Nile, the inhabitants used to supplicate them at the hands of their Serapis; and committed the most execrable crimes, as actions, forsooth, of religion, to obtain the favour. This occasioned Constantine expressly to prohibit these sacrifices, &c. and to order the nilometer to be removed into the church; whereas, till that time, it had been in the temple of Serapis. Julian the Apostate had it replaced in the temple, where it continued till the time of Theodosius the Great.

The only rational and consistent account, however, which we have of the nilometer is given by the celebrated traveller Mr Bruce. "On the point † of the island Rhode, between Geeza and Cairo, near the middle of the river, is a round tower enclosing a neat well or cistern lined with marble. The bottom of this well is on the same level with the bottom of the Nile, which has free access to it through a large opening like an [illegible]. In the middle of the well rises a thin co[illegible]n of eight faces of blue and white marble; of which the foot is on the same plane with the bottom of the river. This pillar is divided into 20 peeks, of 22 inches each. Of these peeks the two lowermost are left, without any division, to stand for the quantity of sludge which the water deposites there. Two peeks are then divided, on the right hand, into 24 digits each; then on the left, four peeks are divided into 24 digits; then on the right, four; and on the left another four: again, four on the right, which completes the number of 18 peeks from the first division marked on the pillar, each peek being 22 inches. Thus the whole marked and unmarked amounts to something more than 36 feet English.

† *Bruce's Travels*. Vol. III.

On the night of St John, when, by the falling of the dew, they perceive the rain water from Ethiopia [illegible] with the Nile at Cairo, they begin to announce the elevation of the river, having then five peeks of water marked on the nilometer, and two unmarked for the sludge, of which they take no notice. Their first proclamation, supposing the Nile to have risen 12 digits, is 12 from 6, or it wants 12 digits to be six peeks. When it has risen three more, it is nine from six; and so on, till the whole 18 be filled, when all the land of Egypt is fit for cultivation. Several canals are then opened, which convey the water into the desert, and hinder any further stagnation on the fields. There is indeed a great deal of more water to come from Ethiopia; but were the inundation suffered to go on, it would not drain soon enough to fit the land for tillage: and to guard against this mischief is the principal use of the nilometer, though the Turkish government makes it an engine of taxation. From time immemorial the Egyptians paid, as tribute to the king, a certain proportion of the fruit of the ground; and this was anciently ascertained by the elevation of the water on the nilometer, and by the mensuration of the land actually overflowed. But the Saracen government, and afterwards the Turkish, has taxed the people by the elevation alone of the water, without attending to its course over the country, or the extent of the land actually overflowed; and this tax is sometimes cruelly oppressive.

Nimbus ‖ Nimrod.

NIMBUS, in antiquity, a circle observed on certain medals, or round the heads of some emperors; answering to the circles of light drawn round the images of saints.

NIMEGUEN, a large, handsome, and strong town of the Netherlands, and capital of Dutch Guelderland, with a citadel, an ancient palace, and several forts. It is noted for the peace concluded there in 1679. It has a magnificent town house, and the inhabitants are greatly given to trade. It is seated on the Vahal or Wahal, between the Rhine and the Maese. It is the utmost eastern boundary of the Netherlands. It contains two Dutch churches, a French Calvinist and a Lutheran church, five Popish, and several hospitals. It was once a Hans-town and an imperial city. It is now the seat of government, has a canal to Arnheim, and considerable trade to some parts of Germany: it trades also in fine beer brewing, fattening of cattle, and exporting of its butter, which is extremely good, into all the other provinces. It is in E. Long. 5. 50. N. Lat. 51. 55.

NIMETULAHITES, a kind of Turkish monks, so called from their founder Nimetulahi, famous for his doctrines and the austerity of his life.

NIMPO, a city and sea-port town of China, in the province of Chekiang. It is seated on the eastern sea of China, over against Japan. It is a city of the first rank, and stands at the confluence of two small rivers, which, after their union, form a channel that reaches to the sea, and is deep enough to bear vessels of 200 tons burden. The walls of Nimpo are 5000 paces in circumference, and are built with freestone. There are five gates, besides two water gates for the passage of barks into the city; a tower several stories high, built of bricks; and a long bridge of boats, fastened together with iron chains, over a very broad canal. This city is commanded by a citadel built on a very high rock, by the foot of which all vessels must necessarily pass. The Chinese merchants of Siam and Batavia go to this place yearly to buy silks, which are the finest in the empire. They have also a great trade with Japan, it being but two days sail from hence: thither they carry silks, stuffs, sugar, drugs, and wine; and bring back copper, gold, and silver. E. Long. 122. 0. N. Lat. 30. 0.

NIMROD, the sixth son of Cush, and in all appearance much younger than any of his brothers: for Moses mentions the sons of Raamah, his fourth brother, before he speaks of him. What the sacred historian says of him is short; and yet he says more of him than of any other of the posterity of Noah, till he comes to Abraham. He tells us, that "Nimrod began to be a mighty one in the earth;" that he was

a "mighty hunter before the Lord," even to a proverb; and that "the beginning of his kingdom was Babel, and Erech, and Accad, and Calneh, in the land of Shinar."

From this account he is supposed to have been a man of extraordinary strength and valour. Some represent him as a giant; all consider him as a great warrior. It is generally thought, that by the words *a mighty hunter*, is to be understood, that he was a great tyrant; but some of the rabbins interpret these words favourably, saying, that Nimrod was qualified by a peculiar dexterity and strength for the chase, and that he offered to God the game which he took; and several of the moderns are of opinion, that this passage is not to be understood of his tyrannical oppressions, or of hunting of men, but of beasts. It must be owned, that the phrase *before the Lord* may be taken in a favourable sense, and as a commendation of a person's good qualities; but in this place the generality of expositors understand it otherwise.

Hunting must have been one of the most useful employments in the times just after the dispersion, when all countries were over-run with wild beasts, of which it was necessary they should be cleared, in order to make them habitable; and therefore nothing seemed more proper to procure a man esteem and honour in those ages, than his being an expert hunter. By that exercise, we are told, the ancient Persians fitted their kings for war and government; and hunting is still, in many countries, considered as one part of a royal education.

There is nothing in the short history of Nimrod which carries the least air of reproach, except his name, which signifies a *rebel*; and that is the circumstance which seems to have occasioned the injurious opinions which have been entertained of him in all ages. Commentators, being prepossessed in general that the curse of Noah fell upon the posterity of Ham, and finding this prince stigmatized by his name, have interpreted every passage relating to him to his disadvantage. They represent him as rebel against God, in persuading the descendants of Noah to disobey the divine command to disperse, and in setting them to build the tower of Babel, with an impious design of scaling heaven. They brand him as an ambitious usurper, and an insolent oppressor; and make him the author of the adoration of fire, of idolatrous worship given to men, and the first persecutor on the score of religion. On the other hand, some account him a virtuous prince, who, far from advising the building of Babel, left the country, and went into Assyria, because he would not give his consent to that project.

Nimrod is generally thought to have been the first king after the flood; though some authors, supposing a plantation or dispersion prior to that of Babel, have made kings in several countries before his time. Mizraim is thought by many who contend for the antiquity of the Egyptian monarchy, to have begun his reign much earlier than Nimrod; and others, from the uniformity of the languages spoken in Assyria, Babylonia, Syria, and Canaan, affirm those countries to have been peopled before the confusion of tongues.

The four cities Moses gives to Nimrod constituted a large kingdom in those early times, when few kings had more than one; only it must be observed, that possessions might at first have been large, and afterwards divided into several parcels; and Nimrod being the leader of a nation, we may suppose his subjects settled within those limits; whether he became possessed of those cities by conquest or otherwise, does not appear; it is most probable he did not build Babel, all the posterity of Noah seeming to have been equally concerned in that affair; nor does it appear that he built the other three, though the founding of them, and many more, with other works, are attributed to him by some authors. It may seem also a little strange, that Nimrod should be preferred to the regal dignity, and enjoy the most cultivated part of the earth then known, rather than any other of the elder chiefs or heads of nations, even of the branch of Ham. Perhaps it was conferred on him for his dexterity in hunting; or, it may be, he did not assume the title of king till after his father Cush's death, who might have been settled there before him, and left him the sovereignty; but we incline to think, that he seized Shinar from the descendants of Shem, driving out Ashur, who from thence went and founded Nineveh, and other cities in Assyria.

The Scripture does not inform us when Nimrod began his reign: Some date it before the dispersion; but such a conjecture does not seem to suit with the Mosaical history: for before the dispersion we read of no city but Babel; nor could there well be more, while all mankind were yet in a body together; but when Nimrod assumed the regal title, there seem to have been other cities; a circumstance which shews it was a good while after the dispersion. writers of the Universal History place the of his reign 30 years from that event, and in lihood it should be placed rather later than earlier.

Authors have taken a great deal of pains to find Nimrod in profane history: some have imagined him to be the same with Belus, the founder of the Babylonish empire; others take him to be Ninus, the first Assyrian monarch. Some believe him to have been Evechous, the first Chaldean king after the deluge; and others perceive a great resemblance between him and Bacchus, both in actions and name. Some of the Mahommedan writers suppose Nimrod to have been Zohak, a Persian king of the first dynasty: others contend for his being Cay Caus, the second king of the second race; and some of the Jews say he is the same with Amraphel the king of Shinar, mentioned by Moses. But there is no certainty in these conjectures, nor have we any knowledge of his immediate successors.

The Scripture mentions nothing as to the death of Nimrod; but authors have taken care that such an essential circumstance in his history should not be wanting. Some of the rabbins pretend he was slain by Esau, whom they make his contemporary. There is a tradition that he was killed by the fall of the tower of Babel, which was overthrown by tempestuous winds. Others say, that as he led an army against Abraham, God sent a squadron of gnats, which destroyed most of them; and particularly Nimrod, whose brain was pierced by one of those insects.

NINE, the last of the radical numbers or characters from the combination of which any definite number, however large, may be produced. "It is observed

Nineveh.

observed by arithmeticians (says Hume), that the products of 9 compose always either 9 or some lesser products of 9, if you add together all the characters of which any of the former products is composed: thus of 18, 27, 36, which are products of 9, you make 9, by adding 1 to 8, 2 to 7, 3 to 6. Thus 369 is a product also of 9; and if you add 3, 6, and 9, you make 18, a lesser product of 9." See *Hume's Dialogues on Nat. Relig.* p. 167, 168, &c. 2d. edit.

NINEVEH (anc. geog.), the capital city of Assyria, founded by Ashur the son of Shem (Gen. x. 11.); or, as others read the text, by Nimrod the son of Cush.

However this be, yet it must be owned, that Nineveh was one of the most ancient, the most famous, the most potent, and largest cities of the world. It is very difficult exactly to assign the time of its foundation; but it cannot be long after the building of Babel. It was situated upon the banks of the Tigris; and in the time of the prophet Jonas, who was sent thither under Jeroboam II. king of Israel, and, as Calmet thinks, under the reign of Pul, father of Sardanapalus, king of Assyria, Nineveh was a very great city, its circuit being three days journey (Jonah iii. 3.) Diodorus Siculus, who has given us the dimensions of it, says it was 480 stadia in circumference, or 47 miles; and that it was surrounded with lofty walls and towers; the former being 200 feet in height, and so very broad that three chariots might drive on them abreast; and the latter 200 feet in height, and 1500 in number; and Strabo allows it to have been much greater than Babylon. Diodorus Siculus was, however, certainly mistaken, or rather his transcribers, as the authors of the Universal History think, in placing Nineveh on the Euphrates, since all historians as well as geographers who speak of that city, tell us in express terms that it stood on the Tigris. At the time of Jonah's mission thither, it was so populous, that it was reckoned to contain more than six score thousand persons, who could not distinguish their right hand from their left (Jonah iv. 11.), which is generally explained of young children that had not yet attained to the use of reason; so that upon this principle it is computed that the inhabitants of Nineveh were then above 600,000 persons.

Nineveh was taken by Arbaces and Belesis, in the year of the world 3257, under the reign of Sardanapalus, in the time of Ahaz king of Judah, and about the time of the foundation of Rome. It was taken a second time by Astyages and Nabopolassar from Chynaladanus king of Assyria in the year 3378. After this time, Nineveh no more recovered its former splendour. It was so entirely ruined in the time of Lucianus Samasatensis, who lived under the emperor Adrian, that no footsteps of it could be found, not so much as the place where it stood. However, it was rebuilt under the Persians, and destroyed again by the Saracens about the seventh age.

Modern travellers say (A), that the ruins of ancient Nineveh may still be seen on the eastern banks of the Tigris, opposite to the city Mosul or Mousul: (See MOUSUL). Profane historians tell us, that Ninus first founded Nineveh; but the Scripture assures us, that it was Ashur or Nimrod.

The sacred authors make frequent mention of this city; and Nahum and Zephaniah foretold its ruin in a very particular and pathetic manner.

Ninia, Ning-po-fou.

NINIA, or NINIAN, commonly called *St Ninian*, a holy man among the ancient Britons. He resided at or near a place called by Ptolemy *Luccopibia*, and by Bede *Candida Rasa;* but the English and Scotch called it *Whitherne.* We mention him, because he is said to have been the first who converted the Scots and Picts to the Christian faith; which he did during the reign of Theodosius the Younger. Bede informs us, that he built a church dedicated to St Martin, in a style unknown to the Britons of that time; and adds, that during his time the Saxons held this province (*Gallovidia*, now *Galloway*), and that, as in consequence of the labours of this saint the converts to Christianity increased, an episcopal see was established there. Dr Henry, considering that "few or none of the writings of the most ancient fathers of the British church are now extant, and since little being said of them by their cotemporaries, we can know little of their personal history and of the extent of their erudition," gives a short account of some of them. Of St Ninian he says, "he was a Briton of noble birth and excellent genius. After he had received as good an education at home as his own country could afford, he travelled for his further improvement, and spent several years at Rome, which was then the chief seat of learning as well as of empire. From thence he returned into Britain, and spent his life in preaching the gospel in the most uncultivated parts of it, with equal zeal and success."

There is a small town called *St Ninian*, about a mile south of Stirling. Its church had been occupied by the rebels in 1745 as a powder magazine; who on their return blew it up in such haste, as to destroy some of their own people and about fifteen spectators.

NING-PO-FOU, called by the Europeans *Liampo*, is an excellent port, on the eastern coast of China, opposite



(A) This assertion, however, is far from seeming probable; for every trace of it seems to have so totally disappeared, even so early as A. D. 627, that the vacant space afforded a spacious field for the celebrated battle between the emperor Heraclius and the Persians. There are few things in ancient history which have more puzzled the learned world, than to determine the spot where this city stood. Mr Ives informs us, that some have imagined it stood near Jonah's tomb; others, however, place it at another place, some hours journey up the Tigris. These different opinions, however, seem perfectly reconcilable; for it appears at least probable, that ancient Nineveh took in the whole of the ground which lies between these two ruined places. Mr Ives adds, that "what confirms this conjecture is, that much of this ground is now hilly, owing no doubt to the rubbish of the ancient buildings. There is one mount of 200 or 300 yards square, which stands some yards north-east of Jonah's tomb, whereon it is likely a fortification once stood. It seems to have been made by nature, or perhaps both by nature and art, for such an use."

Ninon || Nio.

site to Japan. Eighteen or twenty leagues from this place is an island called *Tcheou-chan*, where the English first landed on their arrival at China.

The silks manufactured at Ning-po are much esteemed in foreign countries, especially in Japan, where the Chinese exchange them for copper, gold, and silver. This city has four others under its jurisdiction, besides a great number of fortresses.

NINON L'ENCLOS, a celebrated lady in the court of France, was of a noble family, and born at Paris in the year 1615; but rendered herself famous by her wit and gallantries. Her mother was a lady of exemplary piety; but her father early inspired her with the love of pleasure. Having lost her parents at 14 years of age, and finding herself mistress of her own actions, she resolved never to marry: she had an income of 10,000 livres a-year; and, according to the lessons she had received from her father, drew up a plan of life and gallantry, which she pursued till her death. Never delicate with respect to the number, but always in the choice, of her pleasures, she sacrificed nothing to interest; but loved only while her taste for it continued; and had among her admirers the greatest lords of the court. But though she was light in her amours, she had many virtues.—She was constant in her friendship, faithful to what are called the *laws of honour*, of strict veracity, disinterested, and more particularly remarkable for the exactest probity. Women of the most respectable characters were proud of the honour of having her for their friend; at her house was an assemblage of every thing most agreeable in the city and the court; and mothers were extremely desirous of sending their sons to that school of politeness and good taste, that they might learn sentiments of honour and probity, and those other virtues that render men amiable in society. But the illustrious Madame de Sevigné with great justness remarks in her letters, that this school was dangerous to religion and the Christian virtues; because Ninon L'Enclos made use of seducing maxims, capable of depriving the mind of those invaluable treasures. Ninon was esteemed beautiful even in old age; and is said to have inspired violent passions at 80. She died at Paris in 1705. This lady had several children; one of whom, named *Chevalier de Villiers*, occasioned much discourse by the tragical manner in which he ended his life. He became in love with Ninon, without knowing that she was his mother; and when he discovered the secret of his birth, stabbed himself in a fit of despair. There have been published the pretended Letters of Ninon L'Enclos to the Marquis de Sevigné.

NINTH, in music. See INTERVAL.

NINUS, the first king of the Assyrians, was, it is said, the son of Belus. It is added, that he enlarged Nineveh and Babylon; conquered Zoroaster king of the Bactrians; married Semiramis of Ascalon; subdued almost all Asia; and died after a glorious reign of 52 years, about 1150 B. C.; but all these facts are uncertain. See SEMIRAMIS.

NIO, an island of the Archipelago, between Naxi to the north, Armago to the east, Santerino to the south, and Sikino to the west, and is about 35 miles in circumference. It is remarkable for nothing but Homer's tomb, which they pretend is in this island; for they affirm that he died here in his passage from Samos to Athens. The island is well cultivated, and not so steep as the other islands, and the wheat which it produces is excellent; but oil and wood are scarce. It is subject to the Turks. E. Long. 25. 53. N. Lat. 36. 35.

Niobe.

NIOBE, (fab. hist.) according to the fictions of the poets was the daughter of Tantalus, and wife of Amphion king of Thebes; by whom she had seven sons and as many daughters. Having become so proud of her fertility and high birth, as to prefer herself before Latona, and to slight the sacrifices offered up by the Theban matrons to that goddess, Apollo and Diana, the children of Latona, resented this contempt. The former slew the male children and the latter the female; upon which Niobe was struck dumb with grief, and remained without sensation. Cicero is of opinion, that on this account the poets feigned her to be turned into stone.

The story of Niobe is beautifully related in the sixth book of the Metamorphoses of Ovid. That poet thus describes her transformation into stone.

> Widow'd and childless, lamentable state!
> A doleful sight, among the dead she sat;
> Harden'd with woes, a statue of despair,
> To ev'ry breath of wind unmov'd her hair;
> Her cheek still redd'ning, but its colour dead,
> Faded her eyes, and set within her head.
> No more her pliant tongue its motion keeps,
> But stands congeal'd within her frozen lips.
> Stagnate and dull, within her purple veins,
> Its current stopp'd, the lifeless blood remains.
> Her feet their usual offices refuse,
> Her arms and neck their graceful gestures lose:
> Action and life from every part are gone,
> And ev'n her entrails turn to solid stone.
> Yet still she weeps; and whirl'd by stormy winds,
> Borne thro' the air, her native country finds;
> There fix'd, she stands upon a bleaky hill;
> There yet her marble cheeks eternal tears distil.

Niobe in this statue is represented as in an ecstacy of grief for the loss of her offspring, and about to be converted into stone herself. She appears as if deprived of all sensation by the excess of her sorrow, and incapable either of shedding tears or of uttering any lamentations, as has been remarked by Cicero in the third book of his Tusculan Questions. With her right hand she clasps one of her little daughters, who throws herself into her bosom; which attitude equally shows the ardent affection of the mother, and expresses that natural confidence which children have in the protection of a parent. The whole is executed in such a wonderful manner, that this, with the other statues of her children, is reckoned by Pliny among the most beautiful works of antiquity: but he doubts to whom of the Grecian artists he ought to ascribe the honour of them (A). We have no certain information at what period

(A) Par hæsitatio in templo Apollinis Sosiani, Niobem cum liberis morientem, Scopas an Praxiteles fecerit.

Niobe ‖ Nisan.

riod this celebrated work was transported from Greece to Rome, nor do we know where it was first erected. Flaminius Vacca only says, that all these statues were found in his time not far from the gate of St John, and that they were afterwards placed by the grand duke Ferdinand in the gardens of the Villa de Medici near Rome.—An ingenious and entertaining traveller (Dr Moore), speaking of the statue of Niobe, says, "The author of Niobe has had the judgment not to exhibit all the distress which he might have placed in her countenance. This consummate artist was afraid of disturbing her features too much, knowing full well that the point where he was to expect most sympathy was there, where distress co-operated with beauty, and where *our pity met our love*. Had he sought it one step farther in *expression*, he had lost it."

In the following epigram this statue is ascribed to Praxiteles:

> Εκ ζωης με Θεοι θεν λιθον. Εκ δε λιθοιο
> Ζωην Πραξιτελης εμπαλιν ειργασατο.

> While for my children's fate I vainly mourn'd,
> The angry gods to massy stone me turn'd;
> Praxiteles a nobler feat has done,
> He made me live again from being stone.

The author of this epigram, which is to be found in the 4th book of the *Anthology*, is unknown. Scaliger the father, in his *Farrago Epigrammatum*, p. 172. ascribes it to Callimachus, but this appears to be only conjecture. Cœlius Calcagninus has made a happy translation of it into Latin.

> *[illegible] in lapidem verterunt numina; sed me*
> *Praxiteles vivam reddidit ex lapide.*

And perhaps the following French version of it will appear no less happy:

> *De vive que j'étais, les Dieux*
> *M'ont changée en pierre massive;*
> *Praxitele a fait beaucoup mieux,*
> *De pierre il m'a sçû rendre vive.*

NIPHON, the largest of the Japan islands, being 600 miles long and 100 broad. See JAPAN.

NIPPERS, in the manege, are four teeth in the fore part of a horse's mouth, two in the upper, and two in the lower jaw. A horse puts them forth between the second and third year.

NIPPLES, in Anatomy. See there, N° 112.

NIPPLE-WORT, in Botany. See LAPSANA.

NISAN, a month of the Hebrews, answering to our March, and which sometimes takes from February or April, according to the course of the moon. It was the first month of the sacred year, at the coming out of Egypt (Exod. xii. 2.), and it was the seventh month of the civil year. By Moses it is called Abib. The name Nisan is only since the time of Ezra, and the return from the captivity of Babylon.

On the first day of this month the Jews fasted for the death of the children of Aaron (Lev. x. 1, 2, 3.) On the tenth day was celebrated a fast for the death of Miriam the sister of Moses; and every one provided himself with a lamb for the passover. On this day the Israelites passed over Jordan under the conduct of Joshua (iv. 19.) On the fourteenth day in the evening they sacrificed the paschal lamb; and the day following, being the [illegible], was held the solemn passover (Exod. xii. 18. &c.) The sixteenth they offered the sheaf of the ears of barley as the first fruits of the harvest of that year (Levit. xxiii. 9. &c.) The twenty-first was the octave of the passover, which was solemnized with particular ceremonies. The twenty-sixth the Jews fasted in memory of the death of Joshua. On this day they began their prayers to obtain the rains of the spring. On the twenty-ninth they called to mind the fall of the walls of Jericho.

Nisi ‖ Nismes.

NISI PRIUS, in law, a judicial writ which lies in cases where the jury being impannelled and returned before the justices of the bank, one of the parties requests to have such a writ for the ease of the country, in order that the trial may come before the justices in the same county on their coming thither. The purport of a writ of *nisi prius* is, that the sheriff is thereby commanded to bring to Westminster the men impannelled, at a certain day, before the justices, "*nisi prius justiciarii domini regis ad assisas capiendas venerint.*"

NISIBIS (anc. geog.), a city both very ancient, very noble, and of very considerable strength, situated in a district called *Mygdonia*, in the north of Mesopotamia, towards the Tigris, from which it is distant two days journey. Some ascribe its origin to Nimrod, and suppose it to be the *Achad* of Moses. The Macedonians called it *Antiochia of Mygdonia* (Plutarch); situated at the foot of Mount Masius (Strabo). It was the Roman bulwark against the Parthians and Persians. It sustained three memorable sieges against the power of Sapor, A. D. 338, 346, and 350; but the emperor Jovianus, by an ignominious peace, delivered it up to the Persians, A. D. 363.——A colony called *Septimia Nisibitana*.——Another *Nisibis*, of Aria, (Ptolemy), near the lake Arias.

Mr Ives, who passed through this place in 1758, tells us, that "it looked pretty at a distance, being seated on a considerable eminence, at the foot of which runs a river, formerly called the *Mygdonius*, with a stone bridge of eleven arches built over it. Just by the river, at the foot of the hill, or hills (for the town is seated on two), begin the ruins of a once more flourishing place, which reach quite up to the present town. From every part of this place the most delightful prospects would appear, were the soil but properly cultivated and planted; but instead of those extensive woods of fruit trees, which Rawolf speaks of as growing near the town, not above thirty or forty straggling trees of any kind can be perceived; and instead of that great extent of arable land on which he dwells so much, a very inconsiderable number of acres are now remaining. The town itself is despicable, the streets extremely narrow, and the houses, even those which are of stone, are mean. It suffered grievously by the famine of 1757, losing almost all its inhabitants either by death or desertion. The streets presented many miserable objects, who greedily devoured rinds of cucumbers, and every other refuse article of food thrown out into the highway. Here the price of bread had risen near 4000 per cent. within the last 14 years.

NISMES, an ancient, large, and flourishing town of France, in Languedoc, with a bishop's see, and an academy. It has such a number of manufactures of

Nobility.

heirs according to the limitation thereof, though he never himself makes use of it. Yet it is frequent to call up the eldest son of a peer to the house of lords by writ of summons, in the name of his father's barony: because in that case there is no danger of his children's losing the nobility in case he never takes his seat; for they will succeed to their grandfather. Creation by writ has also one advantage over that by patent; for a person created by writ holds the dignity to him and his heirs, without any words to that purport in the writ; but in letters patent there must be words to direct the inheritance, else the dignity endures only to the grantee for life. For a man or woman may be created noble for their own lives, and the dignity not descend to their heirs at all, or descend only to some particular heirs: as where a peerage is limited to a man and the heirs male of his body by Elizabeth his present lady, and not to such heirs by any former or future wife.

2. Let us next take a view of a few of the principal incidents attending the nobility,—exclusive of their capacity as members of parliament, and as hereditary counsellors of the crown, for both which we refer to the articles LORDS and PARLIAMENT. And first we must observe, that in criminal cases a nobleman shall be tried by his peers. The great are always obnoxious to popular envy: were they to be judged by the people, they might be in danger from the prejudice of their judges; and would moreover be deprived of the privilege of the meanest subjects, that of being tried by their equals, which is secured to all the realm by magna charta, c. 29. It is said, that this does not extend to bishops; who, though they are lords of parliament, and sit there by virtue of their baronies which they hold *jure ecclesiæ*, yet are not ennobled in blood, and consequently not peers with the nobility. As to peeresses, no provision was made for their trial when accused of treason or felony, till after Eleanor duchess of Gloucester, wife to the lord protector, had been accused of treason, and found guilty of witchcraft, in an ecclesiastical synod, through the intrigues of Cardinal Beaufort. This very extraordinary trial gave occasion to a special statute, 20 Hen. VI. c. 9. which enacts, that peeresses, either in their own right or by marriage, shall be tried before the same judicature as peers of the realm. If a woman, noble in her own right, marries a commoner, she still remains noble, and shall be tried by her peers: but if she be only noble by marriage, then by a second marriage with a commoner she loses her dignity; for as by marriage it is gained, by marriage it is also lost. Yet if a duchess dowager marries a baron, she continues a duchess still: for all the nobility are *pares*, and therefore it is no degradation. A peer or peeress (either in her own right or by marriage) cannot be arrested in civil cases: and they have also many peculiar privileges annexed to their peerage in the course of judicial proceedings. A peer sitting in judgment, gives not his verdict upon oath, like an ordinary juryman, but upon his honour; he answers also to bills in chancery upon his honour, and not upon his oath: but, when he is examined as a witness either in civil or criminal cases, he must be sworn; for the respect which the law shows to the honour of a peer does not extend so far as to overturn a settled maxim, that *in judicio non creditur nisi juratis*. The honour of peers is however so highly tendered by the law, that it is much more penal to spread false reports of them, and certain other great officers of the realm, than of other men: scandal against them being called by the peculiar name of *scandalum magnatum*, and subjected to peculiar punishment by divers ancient statutes.

Nobility, Noble.

A peer cannot lose his nobility but by death or attainder; though there was an instance, in the reign of Edward IV. of the degradation of George Nevile duke of Bedford by act of parliament, on account of his poverty, which rendered him unable to support his dignity. But this is a singular instance: which serves at the same time, by having happened, to show the power of parliament; and, by having happened but once, to show how tender the parliament hath been in exerting so high a power. It hath been said indeed, that if a baron wastes his estate, so that he is not able to support the degree, the king may degrade him: but it is expressly held by later authorities, that a peer cannot be degraded but by act of parliament.

Anton. Matthæus observes, that nobility, among the Romans, was a quite different thing from what it is among us. The nobles, among the Romans, were either those raised to the magistrature, or descended from magistrates: there was no such thing as nobility by patent.

Bartoli says, that doctors, after they have held a professor's chair in an university for 20 years, become noble; and are entitled to all the rights of counts.

But this claim is not admitted in court, &c. though Bartoli's sentiments be backed with those of several other authors, particularly Chassanæus in his *Consuetud. Burgundiæ*, *Boyer sur la Coutume de Berry*; *Faber C. de Dig. Def.* 9. &c. which last, however, restrains Bartoli's rule to doctors in law, and princes physicians.

By an edict of the French King in 1669, it is declared, that trade shall not derogate from nobility, provided the person do not sell by retail.

In Bretagne, by ancient custom, a nobleman loses nothing by trading even in retail: but he resumes all his rights as soon as he ceases traffic, his nobility having slept all the time.

In Germany, a woman, not noble by birth, doth not become, *v. gr.* a countess or baroness by marrying a count or baron: a lady of the higher degree indeed becomes a princess by marrying a prince; but this does not hold of a lady of the lower nobility.

On the coast of Malabar, children are only capable of being noble by the mother's side; it being allowed them to take as many husbands as they please, and to quit them whenever they think good.

NOBLE, *Nobilis*, a person who has a privilege which raises him above a commoner or peasant, either by birth, by office, or by patent from his prince. The word comes from the Latin *nobilis*; formed from the ancient *noscibilis*, "distinguishable, remarkable."

In England, the word *noble* is of a narower import than in other countries; being confined to persons above the degree of knights; whereas, abroad, it comprehends not only knights, but what we simply call *gentlemen*. The nobles of England are also called *pares regni*, as being *nobilitatis pares*, though *gradu impares*.

The Venetian *noblesse* is famous: it is in this that the

the sovereignty of the state resides. It is divided into three classes. The first only comprehends 24 families. The second includes the descendants of all those who were entered in the Golden Book, in 1289, and destined to govern the state, which then began to be aristocratic. The third consists of such as have bought the dignity of noble Venetians. This last class is only admitted to the inferior employs; the two former to all indifferently. The title of *noble Venetians* is sometimes also given to foreign kings, princes, [illegible]

Nobles, among the Romans, [illegible] such as had the *jus imaginum*, or the right of [illegible] the pictures or statues of their ancestors; a right which was allowed only to those whose ancestors had borne some *curule* office, that is, had been *curule ædile*, *censor*, *prætor*, or *consul*. For a long time, none but the *patricii* were the *nobiles*, because no person but of that superior rank could bear any *curule* office; hence in Livy, Sallust, &c. *nobilitas* is used to signify the patrician order, and so opposed to *plebs*. To make the true meaning of *nobiles* still more clear, let it be observed, that the Roman people were divided into *nobiles*, *novi*, and *ignobiles*. *Nobiles* were they who had the pictures, &c. of their ancestors: *novi* were such as had only their own; *ignobiles* were such as had neither. See *Jus Imaginis*.

The Roman nobility, by way of distinction, wore a half moon upon their shoes, especially those of patrician rank.

The Grecian nobility were called Εὐπατρίδαι, as being descended from those old heroic ancestors so famous in history. Such were the *Praxiergidæ*, *Eteobutidæ*, *Alcmæonidæ*, &c. all which had many privileges annexed to their quality; amongst which was this, that they wore grasshoppers in their hair as a badge of nobility.

Noble, a money of account containing six shillings and eight pence.

The noble was anciently a real coin struck in the reign of Edward III. and then called the *penny of gold*; but it was afterwards called a *rose-noble*, from its being stamped with a rose: it was current at 6s. 8d.

NOCERA, a town in Italy, in the dominions of the king of Naples and Sicily, or, as he is more commonly called, the king of the Two Sicilies. It is an episcopal city, but might with greater propriety be styled a cluster of villages; its several parts being extended along the foot of the mountains, form the Città Sotana, or low town; and the bishop's palace, together with some convents embowered in cypress groves, cover the peak of a single hill in a very picturesque manner, and compose the Città Soprana.

Nocera (A), it is reported, contains near 30,000 inhabitants; they are dispersed in forty patches of habitation. Their houses are constructed of two kinds of stone: the common walls are built with yellow tufa dug out of the hills that lie about a mile to the east of the town; which stone seems unquestionably to have been formed by a consolidation of substances thrown out of Vesuvius; because, on opening these quarries, the workmen have frequently discovered tombs, vases, and coins locked up in the body of the stony stratum. The cases of their doors and windows are made of a black stone drawn from the hill of Fiano, two miles to the north: it lies eight feet below the surface, in a bed or vein 140 feet thick, resting upon a base of sand. This seems evidently to be a stream of lava congealed.



Nocera is a place of very considerable antiquity: in the 13th century is was called de Pagani, to distinguish it from a city in Umbria of a similar name; this addition was in allusion to a colony of Saracens which Frederick of Suabia brought from Sicily, and settled here, that they might be out of the way of their dangerous connexions with Africa: hence Nocera has often been confounded with Lucera by the negligent or ignorant chroniclers of the succeeding ages. The most remarkable event that occurs in its history is the siege of its castle, A. D. 1384. E. Long. 12. 55. N. Lat. 43. 2.

*Terra Noceriana*, *Earth of Nocera*, in the materia medica, a species of bole, remarkably heavy, of a grayish-white colour, of an insipid taste, and generally with some particles in it which grit between the teeth. It is much esteemed by the Italians as a remedy for venomous bites, and in fevers; but, excepting as an absorbent and astringent, no dependence is to be had on it.

NOCTAMBULI, Noctambulones, or *Night-walkers*; a term of equal import with *somnambuli*, applied to persons who have a habit of rising and walking about in their sleep. The word is a compound of the Latin *nox*, "night," and *ambulo*, "I walk."

Schenkius, Horstius, Clauderus, and Hildanus, who have wrote of sleep, give us divers unhappy histories of such noctambuli. When the disease is moderate, the persons affected with it only repeat the actions of the day on getting out of bed, and go quietly to the places they frequented at other times; but those who have it in the most violent degree, go up to dangerous places, and do things which would terrify them to think of when they are awake. These are by some called *lunatic* night-walkers, because fits are observed to return with the most frequency and violence at the changes of the moon.—For the cure some recommend purging and a cooling regimen: others are of opinion that the best method is to place a vessel of water at the patient's bedside in such a manner that he will naturally step into it when he gets out of bed; or if that should fail, a person should sit up to watch and beat him every time it happens. See Sleep-walkers, or Somnambuli.

NOCTILUCA, a species of phosphorus, so called because it shines in the dark without any light being thrown upon it: such is the phosphorus made of urine.

NOCTURNAL, something relating to the night, in contradistinction to diurnal.

Nocturnal, *Nocturlabium*, an instrument chiefly used at sea, to take the altitude or depression of some stars about the pole, in order to find the latitude and hour of the night.

Some nocturnals are hemispheres, or planispheres, on



(A) Anciently, Nuceria Alphaterna, a word of unknown etymology. It was a Roman colony, and had its mint.

Num. Nucerin.

1. Caput virile imberbe—Equus stans capite reflexo inter crura. A.. IN..

Nocturnal Node.

on the plane of the equinoctial. Those commonly in use among seamen are two; the one adapted to the polar star, and the first of the guards of the Little Bear; the other to the pole star, and the pointers of the Great Bear.

This instrument consists of two circular plates, applied to each other. The greater, which has a handle to hold the instrument, is about $2\frac{1}{2}$ inches diameter, and is divided into twelve parts, agreeing to the twelve months; and each month subdivided into every fifth day; and so as that the middle of the handle corresponds to that day of the year wherein the star here regarded has the same right ascension with the sun. If the instrument be fitted for two stars, the handle is made moveable. The [illegible] left circle is divided into twenty-four equal parts for the twenty-four hours of the day, and each hour subdivided into quarters. These twenty-four hours are noted by twenty-four teeth to be told in the night. Those at the hour 12 are distinguished by their length. In the centre of the two circular plates is adjusted a long index, moveable upon the upper plate; and the three pieces, viz. the two circles and index, are joined by a rivet which is pierced through the centre with a hole, through which the star is to be observed.

Plate CCCXLVI

To use the nocturnal, turn the upper plate till the long tooth, marked 12, be against the day of the month on the under plate; then, bringing the instrument near the eye, suspend it by the handle with the plane nearly parallel to the equinoctial; and viewing the pole star through the hole of the centre, turn the index about, till, by the edge coming from the centre, you see the bright star or guard of the Little Bear, (if the instrument be fitted to that star): then that tooth of the upper circle, under the edge of the index, is at the hour of the night on the edge of the hour circle: which may be known without a light, by counting the teeth from the longest, which is for the hour 12.

NOD, or the *Land of Nod*. It was to this country that Cain withdrew after his fratricide, (Gen. iv. 16.) The Septuagint, as well as Josephus, read *Naid* instead of *Nod*, and have taken it for the name of a place. It is not easily known what country this was, unless perhaps it was the country of Nyse or Nysea, towards Hyrcania. St Jerome and the Chaldee interpreters have taken the word Nod in the sense of an appellative, for *vagabond* or *fugitive*; "He dwelt a fugitive in the land." But the Hebrew reads, "He dwelt in the land of Nod." (Gen. iv. 16.)

NODAB, a country bordering upon Iturea and Idumæa, but now unknown. We read in the Chronicles, that the tribe of Reuben, assisted by those of Gad and Manasseh, had a war against the Hagarites, the Jeturites, and the people of Nephish, and of Nodab, in which the Israelites had the advantage. 1 Chr. v. 19. But the time and the other particulars of this war are unknown.

NODATED HYPERBOLA, a name given by Sir Isaac Newton to a kind of hyperbola, which, by turning round, decussates or crosses itself.

NODDY. See STERNA.

NODE, a tumour arising on the bones, and usually proceeding from some venereal cause; being much the same with what is otherwise called *exostosis*.

Nodes Noetians.

NODES, in astronomy, the two points where the orbit of a planet intersects the ecliptic.

Such are the two points C and D; of which the node C, where the planet ascends northward above the plane of the ecliptic, is called the *ascending node*, or the *dragon's head*, and is marked thus ☊. The other node D, where the planet descends to the south, is called the *descending node*, or the *dragon's tail*, marked thus ☋.

Plate CCCXLVI N° 1.

The line C[illegible]herein the two circles CEDF and CGDH inte[illegible] called the *line of nodes*. It appears from obs[illegible]ion, that the line of the nodes of all the planets constantly changes its place, and shifts its situation from east to west, contrary to the order of the signs; and that the line of the moon's nodes, by a retrograde motion, finishes its circulation in the compass of 19 years; after which time, either of the nodes having receded from any point of the ecliptic, returns to the same again; and when the moon is in the node, she is also seen in the ecliptic. If the line of nodes were immoveable, that is, if it had no other motion than that whereby it is carried round the sun, it would always look to the same point of the ecliptic, or would keep parallel to itself, as the axis of the earth does.

From what hath been said, it is evident, that the moon can never be observed precisely in the ecliptic, but twice in every period; that is, when she enters the nodes. When she is at her greatest distance from the nodes, viz. in the points E, F, she is said to be in her limits.

The moon must be in or near one of the nodes, when there is an eclipse of the sun or moon.

To make the foregoing account of the motion of the moon's nodes still clearer, let the plane of N° 2. *ibid.* represent that of the ecliptic, S the sun, T the centre of the earth, L the moon in her orbit D N *d n*. N *n* is the line of the nodes passing between the quadrature Q and the moon's place L, in her last quarter. Let now LP, or any part LS, represent the excess of the sun's action at T; and this being resolved into the force LR, perpendicular to the plane of the moon's orbit, and PR parallel to it, it is the former only that has any effect to alter the position of the orbit, and in this it is wholly exerted. Its effect is twofold: 1. It diminishes its inclination by a motion which we may conceive as performed round the diameter D *d*, to which L T is perpendicular. 2. Being compounded with the moon's tangential motion at L, it gives it an intermediate direction L *t*, through which and the centre a plane being drawn, must meet the ecliptic nearer the conjunction C than before.

NODUS, or node, in dialling, a certain point or pole in the gnomon of a dial, by the shadow or light whereof either the hour of the day in dials without furniture, or the parallels of the sun's declination, and his place in the ecliptic, &c. in dials with furniture, are shown. See DIALLING.

NOEOMAGUS LEXUVIORUM, (Ptol.); thought to be the *Civitas Lexoviorum* of the lower age. Now *Lisieux*, a city in Normandy.—Another of the *Tricastini*; a town of Gallia Narbonensis; thought to be *S. Pol. de Trois Châteaux*, six miles to the west of Nyons in Dauphiné.

NOETIANS, in church history, Christian heretics in

in the third century, followers of Noetius, a philosopher of Ephesus, who pretended that he was another Moses sent by God, and that his brother was a new Aaron. His heresy consisted in affirming that there was but one person in the Godhead; and that the Word and the Holy Spirit were but external denominations given to God in consequence of different operations: that, as Creator, he is called *Father*; as Incarnate, *Son*; and as descending on the apostles, *Holy Ghost*.

NOLA, a very ancient city, [illegible] populous and strong, situated in a plain to the [illegible] of Vesuvius, in Campania, said to be built [illegible] Chalcidians; (Justin, Silius Italicus); according to others, by the Tuscans. At this place Hannibal met with the first check by Marcellus. Vespasian added the appellation *Augusta Colonia*, (Frontinus). At this place, or in its neighbourhood, Augustus is said to have expired. It is also said that bells were first invented there in the beginning of the 5th century; hence their Latin names *Nola* or *Campana*. It retains its old name to this day, but it hath vastly fallen short of its ancient splendour. A town of the kingdom of Naples. E. Long. 15. N. Lat. 41. 5.

NOLANA, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 41st order, *Asperifoliæ*. The corolla is campanulated; the style situated betwixt the germens; the seeds are bilocular, and resemble berries.

NOLLE PROSEQUI, is where a plaintiff in an action does not declare in a reasonable time; in which case it is usual for the defendant's attorney to enter a rule for the plaintiff to declare, after which a *non pros.* may be entered. A *nolle prosequi* is esteemed a voluntary confession, that the plaintiff has no cause of action; and therefore if a plaintiff enters his *nolle prosequi*, he shall be amerced; and if an informer cause the same to be entered, the defendant shall have costs.

NOLLET (Jean Antoine), a deacon, licentiate in theology, preceptor to the *Enfans de France* for physics and natural history, regius professor of physics in the college of Navarre, member of the Academy of Sciences at Paris, of the Royal Society of London, of the Institution of Bologna, and of the Academy of Sciences of Erfort; was born at Pimbré, in the diocese of Noyon, on the 17th of November 1700, of respectable but not wealthy parents. To make up the want of riches, they determined to give their son a good education. They sent him to the college of Clermont in Beauvoisis, and afterwards to Beauvais, there to finish his introductory studies. The progress which he made in the different classes, determined them to send him to study philosophy at Paris. Thenceforward they intended him for the clerical order; and they considered the strictness and purity of his morals, together with his unwearied application to study, as sufficient proofs of his vocation. The young Nollet yielded without reluctance to the wishes of his parents. As soon as he was capable of showing an inclination for any thing, he had discovered a taste for physics; but this was not become his ruling passion; he therefore sacrificed it to the study of scholastic divinity, to which he wholly dedicated himself during his time of probation in 1728. No sooner had he been invested with the deaconship, than he solicited and obtained a license to preach. This new occupation, however, did not make him entirely lose sight of those studies which had first engaged his attention. They insensibly began to occupy a greater portion of his time, which was now more equally divided between theology and the sciences. The latter, however, prevailed; and thenceforth he entered into the study of physics with an ardour which was only increased by that kind of privation to which he had been long subject. He was received into the Society of Arts, established at Paris under the patronage of the late count de Clermont. In 1730, the Abbé Nollet was engaged in a work conjunctly with Reaumur and du Fay of the Academy of Sciences. In 1734, he went to London in company with M. M. du Fay, du Hamel, and de Jussieu. His merit procured him a place in the Royal Society without any solicitation. Two years after, he went to Holland, where he formed an intimate connexion with Desaguliers, Gravesande, and Muschenbroeck. On his return to Paris, he resumed the course of experimental physics which he had begun in 1735, and which he continued till 1760. These courses of physics first suggested the idea of particular courses in other branches of science, such as in chemistry, anatomy, natural history, &c. In 1738, the count de Maurepas prevailed on the cardinal Fleury to establish a public class for experimental physics; and the Abbé Nollet was appointed the first professor. In the beginning of the year 1739, he was admitted a member of the Royal Academy of Sciences; and in the month of April following, the king of Sardinia intending to establish a professorship of physics at Turin, invited the Abbé Nollet into his dominions. From thence he travelled into Italy. In 1744, he was honoured with an invitation to Versailles, to instruct the dauphin in experimental philosophy; the king and royal family were often present at his lectures. The qualities as well of his understanding as of his heart gained him the esteem and confidence of his pupil. Going one day in state to Paris, he caused intimation to be made that he was to dine at the Thuilleries. M. Nollet having gone thither to pay his court, the dauphin no sooner perceived him, than he had the goodness to say, "Binet has the advantage of me, he has been at your house." Till the period of his death, this prince showed marks of the strongest attachment and favour for this ingenious philosopher. He would have wished that he had been a little more attentive to the improvement of his fortune. He prevailed upon him to go and pay court to a man in power, whose patronage might have been of service to him. The Abbé Nollet accordingly waited upon the placemen, and made him a present of his works. "I never read any works of that kind," said the patron coldly, and casting a look at the volumes before him. "Sir (replied the Abbé), will you allow them to remain in your antichamber? There perhaps there may be found men of genius who will read them with pleasure." In the month of April 1749, he made a grand tour into Italy, being sent thither for the purpose of making observations. At Turin, Venice, and Bologna, the Abbé Nollet appeared as a deputy from the philosophers of the rest of Europe. During his short stay in Italy, the wonders of electricity were not the only object of his researches;

researches; every part of physics, the arts agriculture, &c. came equally under his notice. Upon his return through Turin, the king of Sardinia, always truly sensible of his merit, offered him the order of Saint Maurice, which he did not think proper to accept without his sovereign's permission. In 1753 the king instituted a class of experimental philosophy in the royal college of Navarre, and appointed the Abbé Nollet professor. In 1757, he received from the king a brevet appointing him preceptor in physics and natural history to the *Enfans de France*. In the month of August, the same year, he was appointed professor of experimental philosophy in the school of Artillery, at that time established at la Fere. In the month of November following, he was admitted as a pensionary of the Royal Academy of Sciences. M. de Cremillo, director general of artillery and fortification, having founded a class of experimental philosophy at Mezieres in 1761, the Abbé Nollet was appointed professor. This celebrated and laborious philosopher, who has rendered the most important services to physics by the discoveries with which he has enriched every branch of this science, but particularly electricity, died at Paris on the 25th of April 1770, aged 70; much regretted by the literary world, and by his friends, of whom his gentle character and beneficent heart had procured him a great number. He often retired from the gay and splendid societies of Paris, to give assistance to his relations, who were by no means in affluent circumstances. His works are, 1. Several papers inserted in the memoirs of the Academy of Sciences; among which one on the Hearing of Fishes is particularly valuable. 2. *Leçons de Physique Experimentale*, 6 vols. 12mo; a book well composed, and uniting pleasure with instruction. 3. *Recueil de Lettres sur l'Electricité*, 3 vols. 12mo, 1753. 4. *Essai sur l'Electricité des corps*, 1 vol. 12mo. 5. *Recherches sur les causes particulieres des Phenomênes Electriques*, one vol. 12mo. 6. *L'Arts experiences*, 3 vols. 12mo, with figures, 1770.

NOMADES, a name given, in antiquity, to several nations, whose whole occupation was to feed and tend their flocks; and who had no fixed place of abode, but were constantly shifting, according to the conveniences of pasturage.—The word comes from the Greek *νεμω*, *pasco*, "I feed."

The most celebrated among the Nomades were those of Africa, who inhabited between Africa properly so called, to the east, and Mauritania to the west. They are also called *Numidæ* or *Numidians*.—Sallust says, they were a colony of Persians brought into Africa with Hercules.

The Nomades of Asia inhabited the coasts of the Caspian sea. The Nomades of Scythia were the inhabitants of Little Tartary; who still retain the ancient manner of living.

NOMARCHA, in antiquity, the governor or commander of a nome, or nomos.—Egypt was anciently divided into several regions or quarters, called *nomes*, from the Greek *νομος*, taken in the sense of a division; and the officer who had the administration of each *nome* or *nomos*, from the king, was called *nomarcha*, from *νομος* and *αρχη* "command."

NOMBRE-DE-DIOS, a town of Mexico, in the province of Darien, a little to the eastward of Porto-Bello. It was formerly a famous place; but it is now abandoned, on account of its unhealthy situation. W. Long. 78. 35. N. Lat. 9. 45.

NOMBRIL POINT, in heraldry, is the next below the fess point, or the very centre of the escutcheon.

Supposing the escutcheon divided into two equal parts below the fess, the first of these divisions is the nombril, and the lower the base.

NOME, or NAME, in algebra, denotes any quantity with a sign prefixed or added to it, whereby it is connected with [illegible] other quantity, upon which the whole becom[illegible]mial, trinomial, or the like. See ALGEBRA.

NOMENCLATOR, in Roman antiquity, was usually a slave who attended upon persons that stood candidates for offices, and prompted or suggested to them the names of all the citizens they met, that they might court them and call them by their names, which among that people was the highest piece of civility.

NOMENCLATORS, among the botanical authors, are those who have employed their labours about settling and adjusting the right names, synonymes, and etymologies of names, in regard to the whole vegetable world.

NOMENCLATURE, NOMENCLATURA, a catalogue of several of the more usual words in any language, with their significations, compiled in order to facilitate the use of such words to those who are to learn the tongue: such are our Latin, Greek, French, &c. Nomenclatures.

The chemical nomenclature has within these few years undergone a total change: we have given a table exhibiting these new names facing page 598 of Volume IV. At that time we were not convinced of the propriety of the new theory, nor was it possible to foresee that it would so soon obtain the approbation of the literary world. True philosophy requires, however, that we should readily change our opinions when we see sufficient grounds, for to *err is human*. In consequence of Lavoisier's system being now so universally adopted, it becomes necessary for us to explain his principles at more length than was thought proper before. This we think our duty, and it therefore shall be our endeavour, in some part of the work, to introduce a sufficient analysis of this celebrated and now almost universally adopted system.

NOMENEY, a town in Germany, in the duchy of Lorrain, situated on the river Seille, 15 miles north of Nancy.

NOMINALS, or NOMINALISTS, a sect of school philosophers, the disciples and followers of Occam, or Ocham, an English Cordelier, in the 14th century. They were great dealers in words, whence they were vulgarly denominated *Word-sellers*; but had the denomination of *Nominalists*, because, in opposition to the *Realists*, they maintained, that words, and not things, were the object of dialectics.

This sect had its first rise towards the end of the 11th century, and pretended to follow Porphyry and Aristotle; but it was not till Ocham's time that they bore the name. The chief of this sect, in the 11th century, was a person called *John*, who, on account of his logical subtilty, was called the *sophist*; and his principal disciples were Robert of Paris, Roscelin of Compiegne, and Arnoul of Laon. At the beginning, the Nominals had the upper hand: but the Realists, though greatly divided among themselves, were supported

ported by men of great abilities; such as Albertus Magnus, T. Aquinas, and Duns Scotus. The minal sect became hereby into disrepute; till William Occam, in the 14th century, again revived it, and filled France and Germany with the flame of disputation. Having joined the party of the Franciscan monks, who strenuously opposed John XXII. that pope himself, and his successors after him, left no means untried to extirpate the philosophy of the Nominalists, which was deemed highly prejud[illegible] the interests of the church: and hence it w[illegible] in the year 1339, the university of Paris, by [illegible]public edict, solemnly condemned and prohibited the philosophy of Occam, which was that of the Nominalists. The consequence was, that the Nominalists flourished more than ever. In the 15th century, the controversy was continued with more vigour and animosity than before; and the disputants were not content with using merely the force of eloquence, but had frequently recourse to more hostile and dangerous weapons; and battles were the consequence of a philosophical question, which neither side understood. In most places, however, the Realists maintained a manifest superiority over the Nominalists. While the famous Gerson, and the most eminent of his disciples were living, the Nominalists were in high esteem and credit in the university of Paris. But upon the death of these patrons, the face of things was much changed to their disadvantage. In the year 1473, Louis XI. by the instigation of his confessor, the bishop of Avranches, issued out a severe edict against the doctrines of the Nominalists, and ordered all their writings to be seized and secured, that they might not be read by the people: but the same monarch mitigated this edict the year following, and permitted some of the books of that sect to be delivered from their confinement. In the year 1481, he not only granted a full liberty to the Nominalists and their writings, but also restored that philosophical sect to its former authority and lustre in the university.

The Nominalists were the founders of the university of Leipsic: and there are many yet abroad who pique themselves on being Nominals.

The Nominals, with the Stoics, admit the formal conceptions or ideas of things, as the subject and foundation of universality: but to this they add names, which represent and signify, after the same univocal manner, and without any distinction, a great variety of single things alike in genus and species.

Whence it is that they are called *Nominals*; as pretending, that to become learned, it is not enough to have just ideas of things, but it is likewise required to know the proper names of the genera and species of things, and to be able to express them clearly and precisely, without confusion or ambiguity.

NOMINATIVE, in grammar, the first CASE of NOUNS which are declinable.

The simple position, or laying down of a noun, or name, is called the *nominative case*; yet it is not so properly a case, as the matter or ground whence the other cases are to be formed, by the several changes and inflections given to this first termination. Its chief use is to be placed in discourse before all verbs, as the subject of the proposition or affirmation.

NONA, a city of Dalmatia, remarkable at present only for its ruins, which might furnish abundant materials to gratify the curiosity of antiquaries; but indeed they are so buried by repeated devastations, to which that unhappy city has been exposed, that rarely any vestige of them appears above ground. "I went thither (says Fortis in his Travels), in hopes of finding something worthy of notice, but was disappointed. Nothing is to be seen that indicates the grandeur of the Roman times; neither are there any remains of barbarous magnificence, to put one in mind of the ages in which the kings of the Croat Slavi had their residence there. It lies on a small island, surrounded by a harbour, which in former times was capable of receiving large ships; but is now become a fetid pool by means of a little muddy river that falls into it, after a course of about six miles through the rich abandoned fields of that district. The ancient inhabitants turned this water into another channel, and made it run through the valley of Drasnich into the sea; and the remains of the bank raised by them for that purpose are still to be seen. Notwithstanding, however, the depopulation of this district, and the dreary situation of Nona in particular, the new inhabitants have not lost courage; and animated by the privileges granted to them by the most serene republic, are endeavouring to bring the population and agriculture once more into a flourishing state. Proper drains for the water would not only render that rich territory habitable, but moreover very fertile; and the brackish marsh that surrounds the walls of Nona is well calculated to supply a considerable quantity of fish, especially eels. The government generously granted the investiture to private persons, who already draw no inconsiderable advantage from the fishing; and did they but adopt better methods, they might every year salt many thousands of eels, which would greatly answer our internal commerce, and save at least a part of the money that goes out of the country for foreign salt fish. To the left of the city of Nona, the walls of some ancient ruinous buildings appear; which probably in ancient times were situated on the main land, though now surrounded by water. The sea forms a narrow channel in this place, which is easily fordable, and, at low water, the smallest boat can scarcely pass."

NONAGE, in law, generally signifies all the time a person continues under the age of 21; but in a special sense, it is all the time that a person is under the age of 14.

NON, CAPE, a promontory on the west coast of Africa, opposite to the Canary islands. W. Long. 12. 0. N. Lat. 44. 28.

NONCONFORMISTS, those who refuse to join the established worship.

Blackst. Comment.

Nonconformists, in England, are of two sorts. First, Such as absent themselves from divine worship in the established church through total irreligion, and attend the service of no other persuasion. These, by the stat. 1 Eliz. c. 2. 23 Eliz. c. 1. and 3 Jac. I. c. 4. forfeit one shilling to the poor every Lord's day they so absent themselves, and 20l. to the king if they continue such default for a month together. And if they keep any inmate thus irreligiously disposed in their houses, they forfeit 10l. *per* month.

The second species of nonconformists are those who offend through a mistaken or perverse zeal. Such

were

Nonconformists.

were esteemed, by the English laws enacted since the time of the Reformation, to be Papists and Protestant dissenters: both of which were supposed to be equally schismatics, in not communicating with the national church; with this difference, that the Papists divided from it upon material, though erroneous, reasons; but many of the dissenters upon matters of indifference, or, in other words, for no reason at all. "Yet certainly (says Sir William Blackstone) our ancestors were mistaken in their plans of compulsion and intolerance. The sin of schism, as such, is by no means the object of temporal coercion and punishment. If, through weakness of intellect, through misdirected piety, through perverseness and acerbity of temper, or (which is often the case) through a prospect of secular advantage in herding with a party, men quarrel with the ecclesiastical establishment, the civil magistrate has nothing to do with it; unless their tenets and practice are such as threaten ruin or disturbance to the state. He is bound indeed to protect the established church: and if this can be better effected by admitting none but its genuine members to offices of trust and emolument, he is certainly at liberty so to do; the disposal of offices being matter of favour and discretion. But this point being once secured, all persecution for diversity of opinions, however ridiculous or absurd they may be, is contrary to every principle of sound policy and civil freedom. The names and subordination of the clergy, the posture of devotion, the materials and colour of the minister's garment, the joining in a known or unknown form of prayer, and other matters of the same kind, must be left to the option of every man's private judgment.

*Blackst. Comment.*

"With regard therefore to *Protestant dissenters*, although the experience of their turbulent disposition in former times occasioned several disabilities and restrictions (which I shall not undertake to justify) to be laid upon them by abundance of statutes; yet at length the legislature, with a true spirit of magnanimity, extended that indulgence to these sectaries, which they themselves, when in power, had held to be countenancing schism, and denied to the church of England. The penalties are conditionally suspended by the statute 1 W. & M. st. 1. c. 18. "for exempting their Majesties Protestant subjects, dissenting from the church of England, from the penalties of certain laws," commonly called the *toleration act*; which declares, that neither the laws above mentioned, nor the statutes 1 Eliz. c. 2. § 14. 3 Jac. I. c. 4 & 5. nor any other penal laws made against Popish recusants (except the test acts), shall extend to any dissenters, other than Papists and such as deny the Trinity: provided, 1. That they take the oaths of allegiance and supremacy, (or make a similar affirmation, being Quakers), and subscribe the declaration against Popery. 2. That they repair to some congregation certified to and registered in the court of the bishop or archdeacon, or at the county sessions. 3. That the doors of such meeting house shall be unlocked, unbarred, and unbolted; in default of which, the persons meeting there are still liable to all the penalties of the former acts. Dissenting teachers, in order to be exempted from the penalties of the statutes 13 and 14 Car. II. c. 4. 17 Car II. c. 2. and 22 Car. II. c. 1. are also to subscribe the articles of religion mentioned in the statute 13 Eliz. c. 12. (viz. those which only concern the confession of the true Christian faith, and the doctrine of the sacraments), with an express exception of those relating to the government and powers of the church, and to infant baptism. And by statute 10 Ann. c. 2. this toleration is ratified and confirmed; and it is declared, that the said act shall at all times be inviolably observed for the exempting such Protestant dissenters as are thereby intended from the pains and penalties therein mentioned. T[illegible] though the offence of nonconformity is by [illegible] universally abrogated, it is suspended, and [illegible] to exist with regard to these Protestant dissenters, during their compliance with the conditions imposed by the act of toleration: and, under these conditions, all persons, who will approve themselves no Papists or oppugners of the Trinity, are left at full liberty to act as their consciences shall direct them in the matter of religious worship. And if any person shall wilfully, maliciously, or contemptuously disturb any congregation, assembled in any church or permitted meeting house, or shall misuse any preacher or teacher there, he shall (by virtue of the same statute) be bound over to the sessions of the peace, and forfeit 20l. But by statute 5 Geo. I. c. 4. no mayor or principal magistrate must appear at any dissenting meeting with the ensigns of his office, on pain of disability to hold that or any other office: the legislature judging it a matter of propriety, that a mode of worship, set up in opposition to the national, when allowed to be exercised in peace, should be exercised also with decency, gratitude, and humility. Neither doth the act of toleration extend to enervate those clauses of the statutes 13 & 14 Car. II. c. 4. and 17 Car. II. c. 2. which prohibit (upon pain of fine and imprisonment) all persons from teaching school, unless they be licensed by the ordinary, and subscribe a declaration of conformity to the liturgy of the church, and reverently frequent divine service *established* by the laws of this kingdom.

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"As to *Papists*, what has been said of the Protestant dissenters would hold equally strong for a general toleration of them; provided their separation was founded only upon difference of opinion in religion, and their principles did not also extend to a subversion of the civil government. If once they could be brought to renounce the supremacy of the Pope, they might quietly enjoy their seven sacraments; their purgatory, and auricular confession; their worship of relicks and images; nay, even their transubstantiation. But while they acknowledge a foreign power, superior to the sovereignty of the kingdom, they cannot complain if the laws of that kingdom will not treat them upon the footing of good subjects.

"The following are the laws that have been enacted against the Papists; who may be divided into three classes, persons professing Popery, Popish recusants convict, and Popish priests. 1. Persons professing the Popish religion, besides the former penalties for not frequenting their parish church, are disabled from taking any lands either by descent or purchase, after 18 years of age, until they renounce their errors; they must at the age of 21 register their estates before acquired, and all future conveyances and wills relating to them; they are incapable of presenting to any advowson, or granting to any other person any avoid-

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ance of the same; they may not keep or teach any school, under pain of perpetual imprisonment; and, if they willingly say or hear mass, they forfeit the one 200, the other 100 merks, and each shall suffer a year's imprisonment. Thus much for persons, who, from the misfortune of family-prejudices, or otherwise, have conceived an unhappy attachment to the Romish church from their infancy, and publicly profess its errors. But if any evil industry is used to rivet these errors upon them; if any person sends another abroad to be educated in the Popish religion, or to reside in any religious house abroad for that purpose, or contributes to their maintenance when there; both the sender, the sent, and the contributor, are disabled to sue in law or equity, to be executor or administrator to any person, to take any legacy or deed of gift, and to bear any office in the realm; and shall forfeit all their goods and chattels, and likewise all their real estate for life. And where these errors are also aggravated by apostacy or perversion; where a person is reconciled to the see of Rome, or procures others to be reconciled, the offence amounts to high treason. 2. Popish recusants, convicted in a court of law of not attending the service of the church of England, are subject to the following disabilities, penalties, and forfeitures, over and above those before mentioned. They are considered as persons excommunicated; they can hold no office or employment: they must not keep arms in their houses, but the same may be seized by the justices of the peace; they may not come within 10 miles of London, on pain of 100l.; they can bring no action at law or suit in equity; they are not permitted to travel above five miles from home, unless by license, upon pain of forfeiting all their goods; and they may not come to court, under pain of 100l. No marriage or burial of such recusant, or baptism of his child, shall be had otherwise than by the ministers of the church of England, under other severe penalties. A married woman, when recusant, shall forfeit two thirds of her dower or jointure, may not be executrix or administratrix to her husband, nor have any part of his goods; and during the coverture may be kept in prison, unless her husband redeems her, at the rate of 10l. a month, or the third part of all his lands. And lastly, as a feme-couvert recusant may be imprisoned, so all others must, within three months after conviction, either submit and renounce their errors, or, if required so to do by four justices, must abjure and renounce the realm: and if they do not depart, or if they return without the king's license, they shall be guilty of felony, and suffer death as felons without benefit of clergy. There is also an inferior species of recusancy, (refusing to make the declaration against Popery enjoined by statute 30 Car. II. st. 2. when tendered by the proper magistrate); which, if the party resides within ten miles of London, makes him an absolute recusant convict; or, if at a greater distance, suspends him from having any seat in parliament, keeping arms in his house, or any horse above the value of 5l. 3. Popish priests are in a still more dangerous condition. By statute 11 & 12 W. III. c. 4. Popish priests, or bishops, celebrating mass or exercising any part of their functions in England, except in the houses of ambassadors, are liable to perpetual imprisonment. And by the statute 27 Eliz. c. 2. any Popish priest, born in the dominions of the crown of England, who shall come over hither from beyond sea (unless driven by stress of weather and tarrying only a reasonable time), or shall be in England three days without conforming and taking the oaths, is guilty of high treason: and all persons harbouring him are guilty of felony without the benefit of clergy.

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This is a short summary of the laws against the Papists; of which the president Montesquieu observes, that they are so rigorous, though not professedly of the sanguinary kind, that they do all the hurt that can possibly be done in cold blood. But in answer to this, it may be observed (what foreigners who only judge from our statute book are not fully apprized of), that these laws are seldom exerted to their utmost rigour: and indeed, if they were, it would be very difficult to excuse them. For they are rather to be accounted for from their history, and the urgency of the times which produced them, than to be approved (upon a cool review) as a standing system of law. The restless machinations of the Jesuits during the reign of Elizabeth, the turbulence and uneasiness of the Papists under the new religious establishment, and the boldness of their hopes and wishes for the succession of the queen of Scots, obliged the parliament to counteract so dangerous a spirit by laws of a great, and then perhaps necessary, severity. The powder-treason, in the succeeding reign, struck a panic into James I. which operated in different ways: it occasioned the enacting of new laws against the Papists; but deterred him from putting them in execution. The intrigues of Queen Henrietta in the reign of Charles I. the prospect of a Popish successor in that of Charles II. the assassination-plot in the reign of King William, and the avowed claim of a Popish pretender to the crown in subsequent reigns, will account for the extension of these penalties at those several periods of our history." But now that all just fears of a pretender may be said to have vanished, and the power and influence of the pope has become feeble, ridiculous, and despicable, not only in Britain, but in almost every kingdom of Europe: and as in fact the British Catholics solemnly disclaim the dangerous principles ascribed to them *; the British legislature, giving way to that liberality of sentiment becoming Protestants, have lately repealed the most rigorous of the above edicts, *viz.* The punishment of Popish priests or Jesuits who should be found to teach or officiate in the services of that church; which acts were felony in foreigners, and high treason in the natives of this kingdom:—The forfeitures of Popish heirs, who had received their education abroad; and whose estates went to the next Protestant heir:—The power given to the son, or other relation, being a Protestant, to take possession of the father's or other relation's estate, during the life of the real proprietor:—And the debarring Papists from the power of acquiring any legal property by purchase.—In proposing the repeal of these penalties, it was observed, That, besides that some of them had now ceased to be necessary, others were at all times a disgrace to humanity. The imprisonment of a Popish priest for life, only officiating in the services of his religion, was horrible in its nature: And although the mildness of government had hitherto softened the rigour of the law in the practice, it was to be remembered that the Roman Ca-

* See their loyal Address to the Throne, May 1, 1778, as inserted in the Magazines or Annual Register for that year.

tholic priests constantly lay at the mercy of the basest and most abandoned of mankind—of common informers; for on the evidence of any of these wretches, the magisterial and judicial powers were of necessity bound to enforce all the shameful penalties of the act. Others of these penalties held out the most powerful temptations for the commission of acts of depravity, at the very thought of which our nature recoils with horror: They seemed calculated to loosen all the bands of society; to dissolve all civil, moral, and religious obligations and duties, to poison the sources of domestic felicity, and to annihilate every principle of honour. The encouragement given to children to lay their hands upon the estates of their parents, and the restriction which debars any man from the honest acquisition of property, need only to be mentioned to excite indignation in an enlightened age.

In order the better to secure the English established church against perils from nonconformists of all denominations, Infidels, Turks, Jews, Heretics, Papists, and Sectaries, there are, however, two bulwarks erected; called the *corporation* and *test acts:* By the former of which, no person can be legally elected to any office relating to the government of any city or corporation, unless, within a twelvemonth before, he has received the sacrament of the Lord's supper according to the rites of the church of England; and he is also enjoined to take the oaths of allegiance and supremacy at the same time that he takes the oath of office: or, in default of either of these requisites, such election shall be void. The other, called the *test act*, directs all officers civil and military to take the oaths and make the declaration against transubstantiation, in any of the king's courts at Westminster, or at the quarter sessions, within six kalendar months after their admission; and also within the same time to receive the sacrament of the Lord's supper, according to the usage of the church of England, in some public church immediately after divine service and sermon, and to deliver into court a certificate thereof signed by the minister and church warden, and also to prove the same by two credible witnesses; upon forfeiture of 500l. and disability to hold the said office. And of much the same nature with these is the statute 7 Jac. I. c. 2. which permits no persons to be naturalized or restored in blood, but such as undergo a like test: which test having been removed in 1753, in favour of the Jews, was the next session of parliament restored again with some precipitation.

*Non-Naturals*, in medicine, so called, because by their abuse they become the causes of diseases.

Physicians have divided the non-naturals into six classes, viz. the air, meats and drinks, sleep and watching, motion and rest, the passions of the mind, the retentions and excretions. See MEDICINE, *passim*.

*Non Obstante, (notwithstanding)* a clause frequent in statutes and letters patent, importing a license from the king to do a thing, which at common law might be lawfully done, but being restrained by act of parliament cannot be done without such license.

*Non Pros.* See NOLLE *Prosequi*.

*Non-Suit*, signifies the dropping of a suit or action, or a renouncing thereof by the plaintiff or defendant; which happens most commonly upon the discovery of some error in the plaintiff's proceedings when the cause is so far proceeded in, that the jury is ready at the bar to deliver in their verdict.

NONES, (NONÆ), in the Roman kalendar, the fifth day of the months January, February, April, June, August, September, November, and December; and the seventh of March, May, July, and October. March, May, July, and October, had six days in their nones; because these alone, in the ancient constitution of the year by Numa, [illegible] days a-piece, the rest having only 29, and [illegible] 30: but when Cæsar reformed the year, and [illegible] other months contain 31 days, he did not allot them six days of nones.

NONJURORS, those who refused to take the oaths to government, and who were in consequence under certain incapacities, and liable to certain severe penalties. It can scarcely be said that there are any nonjurors now in the kingdom; and it is well known that all penalties have been removed both from Papists and Protestants, formerly of that denomination, as well in Scotland as in England. The members of the Episcopal church of Scotland have long been denominated Nonjurors; but perhaps they are now called so improperly, as the ground of their difference from the establishment is more on account of ecclesiastical than political principles.

NONIUS (Peter), in Spanish *Nunez*, a learned Portuguese, and one of the ablest mathematicians of the 16th century, was born at Alcacer. He was preceptor to Don Henry, King Emmanuel's son, and taught the mathematics in the university of Coimbra. He published the following works, by which he gained great reputation: 1. *De arte navigandi*. 2. *Annotationes in theorias planetarum Purbachii;* which are greatly esteemed. 3. A treatise *De Crepusculis*. 4. A treatise on algebra. It is observed in Furetiere's dictionary, that Peter Nonius, in 1530, first invented the angles of 45 degrees made in every meridian, and that he called them *rhumbs* in his language, and calculated them by spherical triangles. Nonius died in 1577, aged 80.

NONIUS, the name which was not many years ago given to the common device for subdividing the arcs of quadrants and other astronomical instruments, from the persuasion that it was invented by *Nonius* or *Nunez*, of whom some account has been given in the preceding article. The generality of astronomers of the present age transferring the honour of the invention from *Nunez* to *Peter Vernier*, a native of Franche Comte, have called this method of division by his name. (See VERNIER). Mr Adams, however, in his *Geometrical and Geographical Essays*, has lately shown that Clevius the Jesuit may dispute the invention with them both. The truth seems to be, that Nunez started the idea, Clevius improved it, and Vernier carried it to its present state of perfection. The method of Nunez, described in his treatise *De Crepusculis*, printed at Lisbon 1542, consists in describing within the same quadrant 45 concentric circles, dividing the outermost into 90 equal parts, the next within into 89, the next into 88, &c. till the innermost was divided into 46 only. On a quadrant thus divided the plumb line or index must cross one or other of the circles very near a point of division; whence, by computation, the degrees

degrees and minutes of the arch might be easily ascertained. This method is also described by Nunez in his treatise *De arte atque ratione navigandi*, where he would fain persuade himself, that it was not unknown to Ptolemy. But as the degrees are thus divided very unequally, and as it is very difficult to attain exactness in the division, especially when the numbers into which the arches are to be divided are incomposite (of which there are no less than nine), the method of diagonals, first published by Thomas Digges Esq; in a treatise entitled *Al*[illegible]*ale mathematicæ*, printed at London in 1573, an[illegible] to be invented by one Richard Chenseler, was substituted in its room. Nonius's method was, however, improved at different times and by different persons; and it must be acknowledged, that if Vernier saw either the original or any of the improvements (and there can be little doubt of his having seen them all), his merit is only that of having applied to an useful practical purpose the speculative invention of another person.

Nonius (Marcellus), a grammarian, and Peripatetic philosopher, born at Tivoli, wrote a treatise, entitled *De proprietate sermonum*. This author is only valuable for his giving fragments of ancient authors that are nowhere else to be found. The above treatise was printed at Paris in 1614, with notes.

NONNIUS, or Nonius (Lewis,) a learned physician of Antwerp in the 17th century, wrote several works which are esteemed; the principal of which are, 1. An excellent treatise entitled *Ichthyophagia, sive de Piscium esu*. 2. *Hispania*; which is of great use in understanding the ancient geography of Spain. 3. A commentary on the medals of Greece, and those of Julius Cæsar, Augustus, and Tiberius, in folio; it contains Goltzius's two works on the same subject. 4. A commentary on Goltzius's account of Greece, the Islands, &c. 5. Poems, &c.

NONNUS, a Greek poet of the 5th century, and native of Panopilis in Egypt, was the author of an heroic poem in 48 books, entitled *Dionysiacorum*, and a paraphrase in verse of St John's Gospel, which may serve as a commentary upon it.

NONUPLA, in the Italian music, denotes a quick time, peculiar to jigs. This species of time is otherwise called *the measure of nine times*, which requires two falls of the hand, and one rise. There are three sorts of nonupla. 1. *Nonupla di semi minime*, or *dupla sesquiquarta*, thus marked $\frac{9}{4}$, where nine crotchets are to be in the bar, of which four make a semibreve in common time, *i. e.* in the down stroke six, and but three up: it is usually beat *adagio*. 2. *Nonupla di crome*, or *sesqui ottava*, marked thus $\frac{9}{8}$, wherein nine quavers make a bar instead of eight in common time, *i. e.* six down and three up: it is beat *presto*. 3. *Nonupla di semicrome* or *super setti partiente nona*, thus distinguished $\frac{9}{16}$, in which nine semiquavers are contained in a bar, whereof sixteen are required in common time, six down, and three up: it is ordinarily beat *prestissimo*. Beside these, there are two other species of nonupla, for which see Tripli.

NOOTKA sound, or, as it was called by Captain Cook, *King George's Sound*, lies Lat. 49. 33. W. Long. 153. 12. It is an entrance or strait to a vast inland sea on the west coast of North America, and is said to resemble the Baltic or Mediterranean in Europe. Upon the sea-coast the land is tolerably high and level; but within the sound it rises into steep hills, which have an uniform appearance. The trees of which the woods are composed, are the Canadian pine, white cyprus, and two or three other sorts of pine. In general, the trees grow here with great vigour, and are of a large size. About the rocks and borders of the woods were seen some strawberry plants, and raspberry, currant, and gooseberry bushes, all in a flourishing state. The principal animals seen here were racoons, martens, and squirrels. Birds are far from being numerous, and those that are to be seen are remarkably shy, owing perhaps to their being continually harassed by the natives, either to eat them, or to become possessed of their feathers to be worn as ornaments. The quebrantahuessos, shags, and gulls, were seen off the coast; and the two last were also frequent in the sound. Though the variety of fish is not very great, yet they are in greater quantities than [illegible]. The principal sorts are the common herring, a silver coloured bream, and another of a brown colour. Captain Cook and Mr King, who visited this place, consider it as an excellent shelter for ships: and in the account of *A Voyage to the Pacific Ocean*, they give some directions for sailing into it. These and other matters of that kind we shall not trouble our readers with; and perhaps the generality of them will be better pleased with the following extract from M[illegible]'s Voyages to the North-west Coast of America.

"The people of the Nootka nation are, in general, robust and well proportioned:—their faces are large and full, their cheeks high and prominent, with small black eyes:—their noses are broad and flat, their lips thick, and they have generally very fine teeth, and of the most brilliant whiteness.

"The manner in which the children of Nootka are treated, when young, is not more extraordinary from its strange, and, as it should appear, total inutility, as from its agreement with the customs of the Chinese and Tartars, to whom this practice gives these people a considerable resemblance. The head of the infant is bound by the mother with a kind of fillet of several folds, as low down as the eyes, in order to give it a certain form, which, at this tender age, it is capable of receiving. It might be supposed, that such a tight drawn ligature must cause considerable pain to the child; but we never observed that any of the infants, in such a state of preparation for sugar-loaf heads, suffered any visible pain or inconvenience.

"Though the custom of compressing the head in this manner gives them an unpleasant appearance, by drawing up the eyebrows, and sometimes producing the disagreeable effect of squinting, as well as of flattening the nose and distending the nostrils, they are by no means an ill-looking race of people. They have also the custom, which is known to prevail in so many Indian nations, of plucking out the beard by the roots, on its first appearance; and, as it continues to sprout, to keep it down by the same practice. It is one of the domestic employments assigned to their wives, to watch this appearance of manhood, and to eradicate the hairs as they come forth; which they do in a very dexterous manner with their fingers, and without giving the least pain in the operation.—Some of them, however, though we saw but very few of this disposition, when they advance in years and become infirm, suffer their beards to grow without interruption. But, notwithstanding

standing they have so great an aversion to the hair of their chin, that of the head is an object of their attentive vanity: it is strong, black, and glossy; grows to a considerable length; and is either tied in a kind of knot on the top of their heads, or suffered to hang down their backs in flowing negligence.

"In their exterior form they have not the symmetry or elegance which is found in many other Indian nations.—Their limbs, though stout and athletic, are crooked and ill shaped; their skin, when cleansed of filth and ochre, is white; and we have seen some of the women, when in a state of cleanliness (which, however, was by no means a common sight, and obtained with difficulty), who not only possessed the fair complexion of Europe, but features that would have attracted notice, for their delicacy and beauty, in those parts of the world where the qualities of the human form are best understood. But these examples of beauty are by no means numerous among the women of Nootka, who are calculated rather to disgust than to charm an European beholder. Their hair, like that of the men, is black; their eyes are of the same colour; and, in exterior appearance, they are not to be immediately distinguished from the men. In their characters they are reserved and chaste; and examples of loose and immodest conduct were very rare among them. There were women in St George's Sound, whom no offers could tempt to meretricious submissions."

All reports concerning Nootka Sound agree in characterizing the inhabitants as "a very inoffensive race of people."—Inoffensive, however, as they are, a custom of a very unnatural, and we should imagine cruel, kind prevails among them: for, together with many other articles which they exposed to sale to Captain Cook's ships, they brought human skulls and hands (part of the flesh still remaining on them), which they acknowledged they had been feeding on; and some of them, we are told, had evident marks of the fire.

From hence it is too apparent, that the horrid practice of devouring their enemies exists here as well as at New Zealand and other South sea islands: and hence, too, appears what men of even the best natural dispositions will be, if left entirely to the freedom of their own will, without law to controul or religion to instruct them. As there are but two villages of the Sound inhabited, the number of people cannot be many; perhaps they are about 2000 in all. Our limits prevent us from being so minute as we could wish to be, respecting the form of their houses and their manner of building them; of their furniture, decorations, and other things of that kind: we can therefore only refer those who wish for further information on this subject to Cook, and other voyagers and travellers, &c.

The employment of the men is chiefly fishing, &c. whilst the women manufacture their garments. Their ingenuity in this and in the mechanic arts is far from being inconsiderable; and in the imitative arts their skill is very great. On these subjects, however, we cannot enlarge: we have in general made it our business, and it certainly is our duty, to dwell, where it can be done, on the manners or religion of the inhabitants of the several places which come under our notice; and they who know the utility of this in developing the philosophy of the human mind, the most important of all sciences, will not blame our intentions, even if they should not approve of the execution. In Cook's Voyages before referred to, we find the following observations on the religion and language of the inhabitants of Nootka Sound.

"Little knowledge we can be supposed to have acquired of the political and religious institutions established among these people. We discovered, however, that there were such men as chiefs, distinguished by the title of *Acw*[illegible] whom the others are, in some degree, subord[illegible] But the authority of each of these great me[illegible]s to extend no farther than to his own family, who acknowledge him as their head. As they were not all elderly men, it is possible this title may be hereditary.

"Nothing that we saw could give us any insight into their notions of religion, except the figures already mentioned, called *Klumma*. These, perhaps, were idols; but as the word *acweek* was frequently mentioned when they spoke of them, we may suppose them to be the images of some of their ancestors, whose memories they venerate. This, however, is all conjecture; for we could receive no information concerning them; knowing little more of their language than to enable us to ask the names of things, and being incapable of holding any conversation with the natives relative to their traditions or their institutions.

"Their language is neither harsh nor disagreeable, farther than proceeds from their pronouncing the *k* and *h* with less softness than we do. As to the composition of their language, we are enabled to say but little. It may, however, be inferred from their slow and distinct method of speaking, that it has few prepositions or conjunctions, and is destitute of even a single interjection to express surprise or admiration. The affinity it may bear to other languages, we have not been able sufficiently to trace, not having proper specimens to compare it with; but from the few Mexican words we have procured, there is an obvious agreement throughout the language, in the freq[illegible] terminations of the words in *l*, *tl*, or *z*.

"The word *wakash* was frequently in the mouths of the people of Nootka. It seemed to express approbation, applause, and friendship. Whenever they appeared to be pleased or satisfied at any sight or occurrence, they would call out *wakash! wakash!*—It is worthy of remark, that as these people do essentially differ from the natives of the islands in the Pacific ocean, in their persons, customs, and language, we cannot suppose their respective progenitors to have belonged to the same tribe, when they emigrated into those places where we now find their descendants."

We cannot finish this article without taking notice of a circumstance, which at the time made a great noise in Europe, and which it is probable will find a place in the future histories of the contending countries.

A small association of British merchants resident in the East Indies had, early in the year 1786, formed the project of opening a trade to this part of the world, for the purpose of supplying the Chinese market with furs. The principal point towards which these expeditions were directed, was Port Nootka, or King George's Sound; and the adventurers, being in some degree satisfied with their traffic, took measures,

in the year 1788, to ſecure to themſelves a permanent ſettlement; at the ſame time that the ſhipping employed in this expedition was generally two, and never exceeded the amount of four, ſmall veſſels. The Spaniards conceived ſome jealouſy of the intruſion of the Engliſh into a part of the world which they had long been deſirous to regard as their excluſive property; and accordingly a Spaniſh frigate of 26 guns was deſpatched from the province of Mexico, for the purpoſe of putting an end to this com[illegible] The Spaniſh frigate arrived in May 1789, an[illegible]red two Engliſh veſſels in the following July, [illegible] ſame time taking poſſeſſion of the little ſettlement which had been formed upon the coaſt. Such, in ſhort, is the circumſtance which was likely to involve us in an expenſive war. Happily, however, for both countries, and perhaps for Europe, the matter was at length, after great altercation, amicably ſettled; and it muſt ſtill be ſo freſh in the memories of our readers, that we truſt they will excuſe us from enlarging further upon it—the whole article having extended perhaps to more than a ſufficient length.

NOPAL, Raquette, or *Indian fig*; plants ſo named by the Indians from which the cochineal is collected in Mexico. Theſe plants bear fruits which reſemble our figs; tinge the urine of thoſe who eat them; and probably communicate to the cochineal the property which makes it uſeful to the dyer. The Indians of Mexico cultivate the nopal near their habitations, and ſow, as it were, the inſect which affords the cochineal. They make ſmall neſts of moſs or fine herbs; put twelve or fourteen cochineals into each neſt; place three or four of theſe neſts on each leaf of the nopal; and faſten them there by the prickles of the plant. In the courſe of a few days, thouſands of ſmall inſects iſſue out, and fix themſelves upon the parts of the leaf which are beſt ſheltered and afford the moſt nouriſhment. The cochineals are collected ſeveral times in the courſe of the year; and are deprived of life by ſcalding them, or by putting them into an oven. See Cochineal.

Plate CCCXLVI

NOPALXOCHQUETZALLI, or Nopalcochquetzalli, the prickly pear of Mexico, and common over all the Weſt Indies. See Cactus.

NOPH. See Memphis.

NORBURY, a town in England, in Staffordſhire, on the ſouth-weſt ſide of Eccleſhall. Here is a ſurpriſing echo, which, taken 440 yards north-eaſt from the manor houſe, near a little bank under a wood ſide, repeats in a ſtill day 10 or 11 ſyllables very diſtinctly, or 12 or 13, if ſpoke very quick. It is remarked that the banks of the Black Meer, in this pariſh, grow forward every year over the ſurface of the water, at the rate of three or four yards every ſeven years.

NORDEN (Frederic Lewis), an ingenious traveller and naval officer in the Daniſh ſervice, was born at Gluckſtadt in Holſtein in the year 1708. He was well ſkilled in mathematics, ſhip building, and eſpecially in architecture; and in 1732 obtained a penſion to enable him to travel for the purpoſe of ſtudying the conſtruction of ſhips, particularly the galleys and other rowing veſſels uſed in the Mediterranean. He ſpent near three years in Italy; and Chriſtian VI. being deſirous of obtaining a circumſtantial account of Egypt, Mr Norden at Florence received an order to extend his travels to that country. How he acquitted himſelf in this commiſſion, appears from his Travels into Egypt and Nubia, printed at Copenhagen in folio, 1756; and which were ſoon after tranſlated into Engliſh by Dr Peter Templeman. In the war between England and Spain, Mr Norden, then a captain in the Daniſh navy, attended Count Ulric Adolphus, a ſea captain, to England; and they went out volunteers under Sir John Norris, and afterwards under Sir Chaloner Ogle. During his ſtay in London, Mr Norden was made a fellow of the Royal Society, and gave the public drawings of ſome ruins and coloſſal ſtatues at Thebes in Egypt, with an account of the ſame in a letter to the Royal Society, 1741. His health at this time was declining; and taking a tour to France, he died at Paris in 1742.

NORDHEIM, a town in Germany, in the Hanover quarter. Of the four larger towns of this principality, it is the third in order. It is ſituated on the Ruhme, which runs into the Leine. It contains 500 houſes, and, beſides a ſecularized Lutheran abbey, has one pariſh church, and ſome charitable foundations, and alſo enjoys ſome manufactures.

NORES (Jaſon de), a ſcholar, poet, and philoſopher, was born at Nicoſia in Cyprus. He loſt his fortune when the Turks made themſelves maſters of that iſland in 1570. He retired to Padua; where he acquired great reputation by teaching moral philoſophy. His character had that caſt of ſeverity which is often the conſequence of ſcholaſtic habits. He was one of thoſe men who diſcuſs every thing without being capable of feeling any thing. The *Paſtor Fido* of Gaurini made its appearance; and paſtorals became a faſhionable ſpecies of reading throughout all Itally. Nores, who did not reliſh works of this kind, attacked the production of Guarini; who entirely confuted him in a little piece printed at Ferrara in 1588. Nores made a reply two years after; and the poet was preparing an anſwer ſtill more ſevere than the former, when his antagoniſt died of grief occaſioned by the baniſhment of his only ſon for having killed a Venetian in a duel. He left behind him a great many works, ſome in Italian, and others in Latin. The chief of his Italian works, are, 1. The Poeticke, Padua, 1588, 4to; this edition is rare. 2. A Treatiſe on Republics, 1578, 4to; which he forms on the model of that of the Venetians, his maſters. 3. A Treatiſe on the World and its Parts, Venice, 1571, 8vo. 4. Introduction to three books of Ariſtotle's Rhetoric, Venice, 1584, 4to, valuable. 5. A Treatiſe on what Comedy, Tragedy, and Epic Poetry, may receive from Moral Philoſophy. His Latin works are, 1. *Inſtitutio in Philoſophiam Ciceronis*, Padua, 1576, 8vo. 2. *Brevis et diſtincta ſumma praeceptorum de arte diſcendi, ex libris Ciceronis collecta*, Venice, 1553, 8vo; a good work. 3. *De C[illegible]ſtitutione partium humanæ et civilis philoſophiæ*, 4to. 4. *Interpretatio in artem poeticam Horatii*, &c. In all his works we remark great perſpicuity and accuracy, profound erudition, happy expreſſions, an elevated and ſometimes forcible ſtyle.—His ſon Peter Nores, ſucceſſively ſecretary to ſeveral cardinals, at once a man of letters and a man of buſineſs, left behind him different manuſcripts; among others, the life of Paul IV. in Italian.

NORFOLK, a county of England, ſo called from its

Norfolk.

its northern situation in respect of Suffolk, is bounded on the east and north by the German ocean; on the south by Suffolk, from which it is parted by the rivers Waveney, and the Lesser Ouse; and on the west it is separated from Cambridgeshire by the Greater Ouse, and from a small part of Lincolnshire by the Washes. According to Templeman, it extends in length 57 miles, in breadth 35, and 140 in circumference. It contains an area of 1426 square miles, one city, 32 market towns, 711 villages, according to the book of rates, though some make them 1500, and 236,000 inhabitants, as some have it, and 283,000, according to others. It is divided into 31 hundreds, 164 vicarages, and 660 parishes.

The air differs in different parts of the county according to the soil, which in some places is marshy, especially on the sea coast, and there the air is foggy and unwholesome; in others it is clayey and chalky, poor, lean, and sandy, and there the air is good. The county is almost all champaign, except in some places, where rise gentle hills. The marsh lands yield rich pasture for cattle; the clay grounds pease, rye, and barley; and the sandy heaths feed vast flocks of large sheep, of which some villages are said to keep 4000 or 5000. These heaths abound also in rabbits of a silver gray colour. Walsingham is noted for producing the best saffron. Great quantities of mackarel and herring are caught upon the coasts of this county, the former in the spring, and the latter in September; especially at Yarmouth, where they are cured in a particular manner, and to great perfection. Wood and honey are also very plentiful in this county; and on the coasts jet and ambergrease are sometimes found. The inhabitants are generally strong and active, sagacious and acute. That they are so robust, is the more to be wondered at, because the common people live much on puddings, *Norfolk dumplings*. They are for the most part in easy circumstances, and were formerly very quarrelsome and litigious. In consequence of this disposition, lawyers swarmed among them to such a degree, that a statute was made so early as the reign of Henry VI. to restrain their number. The manufactures of the county, which is exceedingly populous, are chiefly woollen and worsted stuffs and stockings, for which they are well supplied with wool from the vast flocks of sheep bred in it. It gives title of duke to the elder branch of the family of Howard, lies in the diocese of Norwich, and sends twelve members to parliament, viz. two knights for the shire, two citizens for Norwich, and two burgesses for each of the boroughs of Lynn Regis, Great Yarmouth, Thetford, and Castlerising.

The county is well watered, and supplied with fish by the rivers Yare, Thyrn, Waveney, the Greater and Lesser Ouse, and the Bure, besides rivulets. The Bure abounds in excellent perch, and the Yare has a fish peculiar to it called the *ruffe*. The latter rises about the middle of the county; and after being joined by the Waveney and Bure, falls into the sea at Yarmouth. At the equinoxes, especially the autumnal, the Ouse is subject to great inundation, being forced back by the sea, that enters it with great fury. This county was famous at a very early period for its fisheries, which were extensive and valuable, and seem to have been carried on with spirit. It has also been remarkable, for at least 400 years past, for the manufacture of fine worsted stuffs.

Norfolk, Norfolk Island

NORFOLK, a county of Virginia contiguous to North Carolina.

*NORFOLK Island*, a pretty little island of the South sea, lying in 29° 12′ 30″ south latitude, and 168° 16′ east longitude. A colony was lately settled on it: and the following account of it is given in *Governor Phillip's Voyage to Botany Bay*, &c.

"Norfolk Island is about seven leagues in circumference; and if originally formed, like many other small islands, by the eruption of volcanic matter from the bed of the sea, must doubtless have contained a volcano. This conclusion is formed from the vast quantity of pumice stone which is scattered in all parts of it, and mixed with the soil. The crater, or at least some traces of its former existence, will probably be found at the summit of a small mountain, which rises near the middle of the island. To this mountain the commandant has given the name of *Mount Pitt*. The island is exceedingly well watered. At or near Mount Pitt rises a strong and copious stream, which flowing through a very fine valley, divides itself into several branches, each of which retains sufficient force to be used in turning mills; and in various parts of the island springs have been discovered.

"The climate is pure, salubrious, and delightful, preserved from oppressive heats by constant breezes from the sea, and of so mild a temperature throughout the winter, that vegetation continues there without interruption, one crop succeeding another. Refreshing showers from time to time maintain perpetual verdure: not indeed of grass, for none has yet been seen upon the island: but of the trees, shrubs, and other vegetables, which in all parts grow abundantly. On the leaves of these, and of some kinds in particular, the sheep, hogs, and goats, not only live, but thrive and fatten very much. To the salubrity of the air every individual in this little colony can bear ample testimony, from the uninterrupted state of good health which has been in general enjoyed.

"When our settlers landed, there was not a single acre clear of wood in the island, and the trees were so bound together by that kind of creeping shrub called *supple jack*, interwoven in all directions, as to render it very difficult to penetrate far among them. The commandant, small as his numbers were at first, by indefatigable activity soon caused a space to be cleared sufficient for the requisite accommodations, and for the production of esculent vegetables of all kinds in the greatest abundance. When the last accounts arrived, three acres of barley were in a very thriving state, and ground was prepared to receive rice and Indian corn. In the wheat there had been a disappointment, the grain that was sown having been so much injured by the weevil as to be unfit for vegetation. But the people were all at that time in commodious houses; and, according to the declarations of M. King himself, in his letters to Governor Phillip, there was not a doubt that this colony would be in a situation to support itself entirely without assistance in less than four years; and with very little in the intermediate time. Even two years would be more than sufficient for this purpose, could a proper supply of black cattle be sent.



"Fish

Norfolk Island Norham.

"Fish are caught in great plenty, and in the proper season very fine turtle. The woods are inhabited by innumerable tribes of birds, many of them very gay in plumage. The most useful are pigeons, which are very numerous; and a bird not unlike the Guinea fowl, except in colour (being chiefly white), both of which were at first so tame as to suffer themselves to be taken by hand. Of plants that afford vegetables for the table, the chief are cabbage palm, the wild plantain, the fern tree, a kind of spinage, and a tree which produces a diminutive bearing some resemblance to a currant. This, it is hoped, by transplanting and care, will be much improved in size and flavour.

"But the productions which give the greatest importance to Norfolk Island are the pines and the flax plant; the former rising to a size and perfection unknown in other places, and promising the most valuable supply of masts and spars for our navy in the East Indies; the latter not less estimable for the purposes of making sail cloth, cordage, and even the finest manufactures, growing in great plenty, and with such luxuriance as to attain the height of eight feet. The pines measure frequently 160, or even 180 feet in height, and are sometimes 9 or 10 feet in diameter at the bottom of the trunk. They rise to about 80 feet without a branch: the wood is said to be of the best quality, almost as light as that of the best Norway masts; and the turpentine obtained from it is remarkable for purity and whiteness. The fern tree is found also of a great height for its species, measuring from 70 to 80 feet, and affords excellent food for the sheep and other small cattle. A plant producing pepper, and supposed to be the true oriental pepper, has been discovered lately in the island, growing in great plenty; and specimens have been sent to England in order to ascertain this important point."

*Norfolk Sound*, according to the account of Captain George Dixon, is situated in 57° 3′ north latitude, and 135° 36′ west longitude. It is a very extensive place, but how far it stretches to the northward is not known. There may possibly be a passage through to the Bay of Islands, but neither is this certain. The shore, in common with the rest of the coast, abounds with pines; there are also great quantities of the witch hazel. There are various kinds of flowering trees and shrubs, wild gooseberries, currants, and raspberries; wild parsley is found here in great plenty, and it eats excellently either as a salad or boiled amongst soup. The saranne, or wild lily root, grows also in great plenty and perfection. There are a very few wild geese or ducks seen here, but they are shy and difficult of approach.

NORHAM, a town in England, in the county of Northumberland, on the river Tweed, near the mouth of the Till, under the castle, which was anciently erected on a steep rock moated round, for the better security against the incursions of the Scotch moss troopers. It is of great antiquity; and its old church has lately received repairs, and been made a decent place of worship. Antiquities have been discovered here. The church had the privilege of a sanctuary. The castle has been frequently honoured with the presence of sovereigns, particularly Edward I. here received the oath of treaty from John Baliol of Scotland. It has been a formidable structure, a great part of which is in ruins; the site of which, with its demesnes, consisted of 1030 acres.

Noria.

NORIA, a hydraulic machine much used in Spain. It consists of a vertical wheel of 20 feet diameter, on the circumference of which are fixed a number of little boxes or square buckets, for the purpose of raising the water out of the well, communicating with the canal below, and to empty it into a reservoir above, placed by the side of the wheel. The buckets have a lateral orifice to receive and to discharge the water. The axis of this wheel is embraced by four small beams, crossing each other at right angles, tapering at the extremities, and forming eight little arms. This wheel is near the centre of the horse walk, contiguous to the vertical axis, into the top of which the horse beam is fixed: but near the bottom it is embraced by four little beams, forming eight arms similar to those above described, on the axis of the water wheel. As the mule which they use goes round, these horizontal arms, supplying the place of cogs, take hold, each in succession, of those arms which are fixed on the axis of the water wheel, and keep it in rotation.

This machine, than which nothing can be cheaper, throws up a great quantity of water; yet undoubtedly it has two defects: the first is, that part of the water runs out of the buckets and falls back into the well after it has been raised nearly to the level of the reservoir: the second is, that a considerable proportion of the water to be discharged is raised higher than the reservoir, and falls into it only at the moment when the bucket is at the highest point of the circle, and ready to descend.

Both these defects might be remedied with ease, by leaving these square buckets open at one end, making them swing on a pivot fixed a little above their centre of gravity, and placing the trough of the reservoir in such a position as to stop their progress whilst perpendicular; make them turn upon their pivot, and so discharge their contents.

From the reservoir the water is conveyed by channels to every part of the garden; these have divisions and subdivisions or beds, some large, others very small, separated from each other by little channels, into which a boy with his shovel or his hoe directs the water, first into the most distant trenches, and successively to all the rest, till all the beds and trenches have been either covered or filled with water.

Mr Townsend, from whom we have taken the above account, thinks, that on account of the extreme simplicity of this machine, it is an invention of the most remote antiquity. By means of it the inhabitants every morning draw as much water from the well as will serve through the day, and in the evening distribute it to every quarter according to the nature of their crops. The reservoirs into which they raise the water are about 20, 30, or even 40 feet square, and three feet high above the surface of the ground, with a stone cope on the wall, declining to the water for the women to wash and beat their clothes upon.

Our limits preclude us from following Mr Townsend farther in the description of a particular noria used at Barcelona; which he conceives to be the original chain pump,

Noricum pump, or at least its parent. He compares it with similar instruments, and shows its advantages and disadvantages.

Noris. NORICUM (Ptolemy, Tacitus); a Roman province, situated between the Danube on the north, and thus separated from ancient Germany; the Alpes Noricæ on the south; the river Ænus on the west, which separates it from Vindelicia; and Mons Cetius on the east, which divides it from Pannonia. Now containing a great part of Austria, all Saltzburg, Stiria, and Carinthia. It was anciently a kingdom under its own kings (Cæsar, Velleius, Suetonius). *Norici* the people, subdued by Tiberius under Augustus, as allies of the Pannonii (Dio, Velleius). Tacitus reckons Noricum among those provinces which were governed by procurators, officers sent by the emperors to receive and dispose of the public revenue according to order. It was divided into two provinces, but at what time uncertain; supposed as low down as Dioclesian and Constantine, *viz.* the *Noricum Ripense*, running along the south side of the Danube; and the *Noricum Mediterraneum*, extending towards the Alps. How far each of these extended in breadth does not appear: all the account we have of the matter being from Sextus Rufus, and the *Notitia Imperii Occidentalis*. Anciently a country famous for its iron and steel (Horace); as is Stiria at this day, a part of Noricum. A climate cold, and more sparingly fruitful (Solinus).

NORIN, a river which rises in a corner of the Venetian confines, that runs between the rugged marble hills, and is left entirely to itself from its very source; hence a vast tract of land is overflowed by it, and encumbered with reeds, willows, and wild elders. A small space of ground only remains dry between the roots of the hills and the marsh at a place called *Prud*, and that is all covered with pieces of ancient hewn stones, fragments of inscriptions, columns, and capitals, and bass reliefs of the best age, worn and deformed by time, and the barbarism of the northern people, who begun on that side to destroy Narona. The inhabitants, who go often to cut reeds in the marsh, assert, that the vestiges of that large city may still be seen under water. It appears to have been extended over the plain a great way, and undoubtedly it was three miles in length at the foot of the hills. The ancient road is now under water; and it is necessary to ascend a very steep road, in order to pass the point of a craggy hill, on which probably before the Roman times those fortifications were erected that cost Vetinius so much labour.

NORIS (Henry), cardinal, who was a great ornament of the order of the monks of St Augustine, was descended from the president Jason, or James de Noris, and born at Verona 1631. He was carefully educated by his father Alexander Noris, originally of Ireland, and well known by his History of Germany. He discovered from his infancy an excellent understanding, great vivacity, and a quick apprehension. His father instructed him in the rudiments of grammar, and procured an able professor of Verona, called *Massoleim*, to be his preceptor. At 15 he was admitted a pensioner in the Jesuits college at Rimini, where he studied philosophy; after which he applied himself to the writings of the fathers of the church, particularly those of St Augustine: and taking the habit in the convent of the Augustine monks of Rimini, he distinguished himself among that fraternity in a short time by his erudition: insomuch, that as soon as he was out of his noviciate or time of probation, the general of the order sent for him to Rome, in order to give him an opportunity of improving himself in the more solid branches of learning. He did not disappoint his superior's expectations. He gave himself up entirely to his study, and spent whole days, and even nights, in the library of the Angeliques of St Augustine. His constant course was to stick to his books 14 hours a day; and this course he continued till he became a cardinal. By this means he became qualified to instruct others; and on this errand he was sent first to Pezaro, and thence to Perousa, where he took his degree of doctor of divinity; after which proceeding to Padua, he applied himself to finish his History of Pelagianism. He had begun it at Rome at the age of 26; and having completed his design, the book was printed at Florence and published in 1673. The great duke of Tuscany invited him the following year to that city, made him his chaplain, and professor of ecclesiastical history in the university of Pisa, which his highness had founded with that view.

In his history he set forth and defended the condemnation pronounced, in the eighth general council, against Origen and Mopsuesta, the first authors of the Pelagian errors: he also added an account of the Schism of Aquileia, and a Vindication of the Books written by St Augustine against the Pelagians and Semi-Pelagians. The work had procured him a great reputation, but met with several antagonists, to whom he published proper answers: the dispute grew warm, and was carried before the sovereign tribunal of the inquisition. There the history was examined with the utmost rigour, and the author dismissed without the least censure. It was reprinted twice afterwards, and Mr Noris honoured by Pope Clement X. with the title of Qualificator of the Holy Office. Notwithstanding this, the charge was renewed against the Pelagian History, and it was dilated again before the inquisition in 1676; but it came out again with the same success as at first. Mr Noris was now suffered to remain in peace for sixteen years, and taught ecclesiastical history at Pisa, without any molestation, till he was called to Rome by Innocent XII. who made him under-librarian of the Vatican in 1692. This post was the way to a cardinal's hat; his accusers therefore took fresh fire, and published several new pieces against him. Hence the Pope appointed some learned divines, who had the character of having taken neither side, to re-examine Father Noris's books, and make their report of them. Their testimony was so advantageous to the author, that his holiness made him counsellor of the inquisition. Yet neither did this hinder one of his adversaries, the most formidable on account of his erudition, to rise up against him, and attack him warmly, under the assumed title of a *Scrupulous Doctor of the Sorbonne*. Noris tried to remove these scruples in a work which appeared in 1695, under the title of An Historical Dissertation concerning one of the Trinity that suffered in the Flesh; wherein, having justified the monks of Scythia, who made use of that expression, he vindicated himself also from the imputation of having attainted the Pope's infallibility, of

Norkoping, Normandy

of having abused Vincentius Lirinensis, and other bishops of Gaul, as favourers of Semi-Pelagianism, and of having himself gone into the errors of the bishop of Ypres.

His answers to all these accusations were so much to the satisfaction of the pope, that at length his holiness honoured him with the purple in 1695. After this he was in all the congregations, and employed in the most important affairs; so that he had little time to spend in his study, a thing of which he frequently complained to his friends. Upon the death of Cardinal Casanati, he was made chief library keeper of the Vatican in 1770; and two years afterwards nominated, among others, to reform the kalendar: but he died at Rome in 1704 of a dropsy. He was one of the most learned men in the last century: his writings abound with erudition, and are very elegantly finished. He was a member of the Academy; whence he assumed the name of Eucrates Agoretico. His works are numerous, and were published at Verona, in 1729 and 1730, in five volumes folio.

NORKOPING, a town of Sweden, in the province of East Gothland, in east longitude 15° 30′, latitude 58° 20′. Its name signifies "the northern market," in the Swedish language. It stands on the banks of a large river called *Motala*, which coming from the lake *Vetter*, falls a little lower into a gulf called *Brawiken*. It is the largest and most populous town in Sweden, next to Stockholm, conveniently situated near the [illegible] a navigable river, which brings large vessels up to the middle of the town. There are some handsome streets, and the houses in general are neatly built. Some of the churches are worth seeing; but the greatest curiosity are the famous copper mines, where there is a vast number of people constantly at work. In this article the town carries on a very good trade; as also in several other manufactures, as leather, steel, and guns, which they make the best in Sweden.

[illegible] a large space of ground, being ten miles [illegible] but the houses are small and scattered, [illegible] the inhabitants do not exceed 10,000. The river Motala flows through the town, forms a series of cataracts, and is divided into four principal streams, which encircle several rocky islands, covered with houses and manufactories. At the extremity of the town it is navigable for small vessels. Several manufactories are established in the town; 55 fabrics of cloth, which employ 1500 men; 3 sugar-houses; 1 of snuff; 50 mills for grinding corn, which is exported in large quantities; and a brass foundery. A salmon fishery gives employment and riches to many of the inhabitants.

NORMANDY, a province of France, bounded on the north by the English channel; on the east by Picardy and the Isle of France; o the south by Perche and Maine, and one part of Bretagne; and on the west by the ocean. In is about 155 miles in length, 85 in breadth, and 600 in circumference. It is one of the most fertile, and brings in the largest revenue of the kingdom. It abounds in all things except wine, but they supply that defect by cyder and perry. There are vast meadows, fat pastures, and the sea yields plenty of fish. It contains iron, copper, and a great number of rivers and harbours. It carries on a great trade, is very populous, and comprehends a vast number of towns and villages. It is divided into the Upper and Lower; the Upper borders upon Picardy, and the Lower upon Bretagne. It contains seven dioceses or bishoprics, Rouen, Bayeux, Avranches, Evreux, Sées, Lisieux, and Coutances, in which they compute [illegible] parishes, and 80 abbeys. The inhabitants [illegible], and capable of understanding any arts and sciences; but they are chiefly fond of law. The Normans, a people of Denmark and Norway, having entered France under Rollo, Charles the Simple ceded this country to them in 912, which from that time was called *Normandy*, and contains about 8200 square miles. Its chief city is Rouen. Rollo was the first duke, and held it as a fief of the crown of France, and several of his successors after him, till William, the seventh duke, conquered England in 1066: from which time it became a province of England, till it was lost in the reign of King John, and reunited to the crown of France; but the English still keep the islands on the coasts of Normandy.

Normans, Norris

The principal rivers are the Seine, the Eure, the Aure, the Iton, the Dive, the Andelle, the Ril , the Touque, the Drômee, and the Orne: among the sea ports, the principal are those of Dieppe, Havre, Honfleur, Cherburg, and Granville. Rouen is the principal city.

NORMANS, a fierce warlike people of Norway, Denmark, and other parts of Scandinavia. They at different times overran and ravaged most countries in Europe: to the respective histories of those countries we therefore refer for a fuller account of them, as it is impossible to enlarge upon particulars in this place without repeating what has been already said, or may be said, in different parts of the work.

*Norman Characters*, a species of writing introduced into England by William I. From some old manuscripts the Norman writing appears to have been composed of letters nearly Lombardic. In regal grants, charters, public instruments, and law proceedings, this character was used with very little variation from the reign of the Conqueror to that of Edward III. See Writing.

NORRIS, or Noris. See Noris.

NORRIS (John), a learned English divine and Platonic philosopher, was born in 1657 at Collingborne-Kingston, in Wiltshire, of which place his father Mr John Norris was then minister. He bred his son first at Winchester school, and afterwards sent him to Exeter college in Oxford, where he was admitted in 1676; but was elected fellow of All Souls in 1680, soon after he had taken his degree of bachelor of arts. From his first application to philosophy, Plato became his favourite author; by degrees he grew deeply enamoured with the beauties of that divine writer, as he thought him; and took an early occasion to communicate his ideal happiness to the public, by printing an English translation of a rhapsody, under the title of The Picture of Love Unveiled, in 1682. He commenced master of arts in 1684, and the same year opened a correspondence with that learned mystic divine Dr Henry More of Christ's college in Cambridge. He had also a correspondence with the learned Lady Masham, Dr Cudworth's daughter, and the ingenious Mrs Astell. He resided at his college, and had been in

Norris, North. in holy orders five years, when he was presented to the rectory of Newton St Loe, in Somersetshire, 1689; upon which occasion he married and resigned his fellowship. In 1691, his distinguished merit procured him the rectory of Bemerton, near Sarum. This living, upwards of 200l. a-year, came very seasonably to his growing family; and was the more acceptable, for the easiness of the parochial duty, which gave him leisure to make an addition to his revenues by the fruits of his genius; the activity of which produced a large harvest, that continued increasing till 1710. But this activity seems to have become fatal to him; for towards the latter end of his life, he grew very infirm, and died in 1711, in his 54th year, at Bemerton. He was interred in the chancel of that church, where there is a handsome marble monument erected to his memory, with this inscription: "H. S. E. Johannes Norris, parochiæ hujus rector, ubi annos viginti bene latuit curæ pastorali et literis vacans, quo in recessu sibi posuit latè per orbem sparsa ingenii paris ac pietatis monumenta. Obiit an. Dom. 1711, ætatis 54." As to his character, he had a tincture of enthusiasm in his composition, which led him to imbibe the principles of the idealists in philosophy, and the mystics in theology; and the whole turn of his poetry shows, that this enthusiasm alone made him a poet. As an idealist, he opposed Locke, and adorned Malebranche's opinion, of seeing all things in God, with all the advantages of style and perspicuity of expression. In short, his errors, which are harmless enough of themselves, ought to be easily pardoned, on account of the general excellence of his writings, especially upon subjects of practical divinity, which are universally esteemed.

NORTH, one of the four cardinal points of the world; being that point of the horizon which is directly opposite to the sun in meridian. The north wind is generally accompanied with a considerable degree of cold. It sometimes blows with almost irresistible fury. It is often mentioned by the classic authors under the name of *Boreas*, which is of Greek original. See Boreas.

*North Pole.* See Pole.

North (Dudley, lord), the third baron of that accomplished family, was one of the finest gentlemen in the court of King James; but in supporting that character, dissipated and gamed away the greatest part of his fortune. In 1645, he appears to have acted with the parliament; and was nominated by them to be administrator of the admiralty, in conjunction with the great earls of Northumberland, Essex, Warwick, and others. He lived to the age of 85, the latter part of which he passed in retirement; and wrote a small folio of miscellanies, in prose and verse, under this title, A Forest promiscuous of several Seasons Productions, in four parts, 1659.

North (Dudley, lord), son of the former, was made knight of the Bath in 1616, at the creation of Charles prince of Wales; and sat in many parliaments, till excluded by the prevailing party in that which condemned the king. From that period Lord North lived privately in the country, and towards the end of his life entertained himself with books, and, as his numerous issue required, with economy; on which he wrote a little tract, called *Observations and advices economical*, 12mo. His other works are, Passages relating to the long parliament; the history of the life of Lord Edward North, the first baron of the family, addressed to his eldest son; and a volume of Essays. North.

North (Francis lord Guildford, lord-keeper of the great seal in the reigns of Charles II. and James II.) was a third son of the second Dudley lord North, baron of Kertling; and studied at St John's college in Cambridge, from whence he removed to the Middle Temple. He acquired French, Italian, Spanish, and Dutch; and became not only a good lawyer, but was well versed in history, mathematics, philosophy, and music. He was afterwards made the king's solicitor-general, and was chosen to represent the borough of Lynn in parliament. He succeeded Sir Heneage Finch in the post of attorney-general; and Lord Chief Justice Vaughan, in the place of lord chief-justice of the common pleas. He was afterwards made keeper of the great seal: and in 1683 was created a baron, by the title of *Lord Guildford*. He died at his house at Wroxton in 1685. He wrote a philosophical essay on music: a paper on the gravitation of fluids, considered in the bladders of fishes, printed in Lowthorp's abridgement of the Philosophical Transactions; and some other pieces.

North (Right Hon. Frederick), earl of Guildford, Lord North, lord warden and admiral of the Cinque Ports, governor of Dover castle, lord lieutenant and custos rotulorum of Somersetshire, chancellor of the university of Oxford, recorder of Gloucester and Taunton, an elder brother of the Trinity house, president of the Foundling hospital and of the Asylum, a governor of the Turkey Company and of the Charter house, K. G. and LL. D. was born April 13. 1732; and married, May 20. 1756, Miss Ann Speke, an heiress of the ancient family of Dillington in Somersetshire, by whom he has left two sons and three daughters: the eldest son George Augustus, born Sept. 11. 1757, and married, Sept. 30. 1785, to Miss Hobart, succeeds to the earldom and estates. The late earl succeeded his father August 4. 1790. His lordship succeeded the celebrated Mr Charles Townsend as manager of the house of commons and chancellor of the exchequer; and in 1770, on the resignation of the duke of Grafton, was made first lord of the treasury; in which office he continued until the close of the American war, or rather until the formation of the Rockingham ministry, which began the business of peace with the colonies. He was a man of strong mental faculties; and as an orator, at once commanded attention and enforced conviction: but taking the helm at a time when the king's party were unpopular, and when it was supposed that the late earl of Bute was the great machine by which the cabinet was moved, so he continued in that state of unpopularity until he resigned the seals. During the whole of his premiership (and to conduct the helm at that time required uncommonly great abilities) he studiously avoided imposing any taxes that should materially affect the lower class of people. The luxuries, and not the necessaries, of life were repeated objects of his budget. As a financier, he stood high, even in the opinion of opposition; and they were a combination of all the great talents in the kingdom, but, fatally wedded to the destructive plan of subduing the republican

North || North-west Passage.

republican spirit of the Americans, his administration will not only stand marked in the page of history with an immense waste of public treasure, but it will appear besprinkled with the kindred blood of thousands of British subjects. To the very last moment he spoke in the senate, however, he defended that war; and said, he was then, as he was formerly, prepared to meet the minutest investigation as to his conduct in that business; which nothing but the unforeseen intervention of France could have prevented from being crowned with success. His lordship was one of the firmest and most strenuous supporters of the constitution in church and state. He died on the 5th of August 1792. His recollection he retained to his last moments: his family, except Lord North, who came within a few minutes afterwards, were assembled round his bed, and he took leave of them individually. Their grief did not suffer them to leave the room for some time after the event; and Lady Caroline Douglas was at last forced from it. Even Dr Warren, who must be strengthened as far as habit can operate against nature to endure such scenes, ran from this, convulsed with sorrow. If any extent of sympathy can lessen affliction, this family may find such relief; for perhaps no man was ever more generally beloved by all who had access to him than the earl of Guildford.

We may form an opinion of the estimation the celebrated university of Oxford entertained of their chancellor while living, by the very great honour they paid to his remains. About five o'clock in the afternoon of the 15th, the great bell at St Mary's church at Oxford rang out, which was a signal that the funeral procession had arrived in the environs of that city. The officers of the university, and the whole body of resident students, were previously assembled in Magdalen College, in order to pay some tribute to the memory of their deceased chancellor. They joined the procession at Magdalen Bridge, and paraded on foot before the herse up the high street to Carfax; from thence down the corn market to St Giles's church at the town's end, in a most solemn manner. Here they halted, and opening to the right and left, the herse and other carriages passed through, the whole university being uncovered. The herse and attendants then proceeded to Banbury, where his lordship's remains were deposited in the family vault.

*North Cape*, the most northerly promontory in Europe, on the coast of Norway. E. Long. 21. 0. N. Lat. 78. 0.

*North Ferry*, a small village, on the north side of the frith of Forth, at the Queen's Ferry passage. There was here formerly a chapel, served by the monks of Dunfermline, and endowed by Robert I. Near it are large granite quarries, which partly supply London with paving stones, and employ many vessels for the conveyance. "The granite (Mr Pennant says) lies in perpendicular strata, and above is a reddish earth, filled with micaceous friable nodules."

*North Foreland*, a cape or promontory of Kent, in the isle of Thanet, four miles east of Margate. Between this and the South Foreland are the Downs, through which all ships pass that are bound to or from the west. E. Long. 1. 25. N. Lat. 51. 25.

*North-West Passage*, a passage to the Pacific ocean through Hudson's bay or Davis's straits, and which hath been frequently attempted without success; notwithstanding which, many people are still of opinion that it is practicable.

North-west Passage.

The idea of a passage to the East Indies by the north pole, or through some opening near to it, was suggested as early as the year 1527. The person who had the honour to conceive this idea was Robert Thorne, a merchant of Bristol, who addressed two papers on the subject, the one to King Henry VIII. the other to Dr Ley, ambassador from that monarch to the emperor Charles V. To remove any objection to the undertaking, which might be drawn from the supposed danger, he insists, in his address to the king, upon the great advantages of constant daylight in the polar seas, and the probability of the climate being in those regions temperate during the summer months. In the paper addressed to Dr Ley, he observes that cosmographers may as probably be mistaken in the opinion which they entertain of the polar regions being impassable from extreme cold, as it has been found they were in supposing the countries under the line to be uninhabitable from excessive heat.

The possibility of the passage was, in consequence of these addresses, very generally supposed; and in 1557, Sir Martin Forbisher sailed to 62 north latitude, where he discovered the straits which have since bore his name. In 1577, Barne, in a book entitled the *Regiment of the Sea*, mentions a north-west passage as one of the five ways to Cathay; and dwells on the mildness of the climate, which, from the constant presence of the sun during summer, he imagines must be found near the pole. In 1578, George Best, a gentleman who had been with Sir Martin Forbisher in his voyages of discovery, wrote a very ingenious discourse to prove all parts of the world habitable. It does not, however, appear that any voyage was undertaken, for the express purpose of attempting to sail to India in a north-west direction, till the year 16[illegible], when Henry Hudson was sent, at the expence of some merchants in London, to discover a passage by the north pole to Japan and China. He sailed from Gravesend on the 1st of May, and on the 21st of June fell in with the land to the westward, in latitude 73, which he named *Hold-with-hope*. On the 27th he discovered Spitsbergen, and met with much ice. The highest latitude in which he made an observation was 80° 27′. See Hudson.

In March 1609, Jones Poole was sent by Sir Thomas Smith, and the rest of the Muscovy Company, to make further discoveries towards the north pole. After great severity of weather, and much difficulty from ice, he made the south part of Spitsbergen on the 16th of May; and sailing along and sounding the coast, he made many accurate discoveries; but was not in that voyage able to proceed beyond 79° 50′. He was again employed (1611), in a small vessel called the *Elizabeth*, to attempt the north-west passage; but after surmounting numberless difficulties, and penetrating to 80° of latitude, he lost his ship at Spitsbergen. Two voyages, equally unsuccessful, were made in 1614 and 1615, by Baffin and Fotherby; the latter of whom concludes the account of his discoveries and dangers, with exhorting the company which employed him not to adventure more than 150l. or 200l. at most on yearly voyages to these seas.

Hitherto nothing had been done in this great undertaking but by private adventurers, fitted out for

North-west Passage.

the double purpose of discovery and present advantage; and the polar regions were suffered to remain unexplored in that direction, from the year 1615 till 1773 when the earl of Sandwich, in consequence of an application which had been made to him by the Royal Society, laid before his majesty a proposal for an expedition to try how far navigation is practicable towards the north pole. Upon receiving this proposal, his majesty was pleased to direct that the voyage should be immediately undertaken, with every assistance that could contribute to its success. Accordingly, the Racehorse and Carcass bombs were fitted out for the purpose, and the command of the expedition given to Captain Phipps, now Lord Mulgrave. His Lordship's instructions were to proceed up to the pole, or as far towards it as possible, and as nearly upon a meridian as the ice or other obstructions should admit; and during the course of the voyage, to make such observations of every kind as might be useful to navigation, or tend to the promotion of natural knowledge. A very accurate account of this voyage was published by his Lordship in 1774. He had, by exerting all the powers of a skilful and intrepid seaman, forced his way, on the 1st of August, to 80° 37'; but could proceed no farther, as he was there opposed by one continued plain of smooth unbroken ice, bounded only by the horizon.

Many other attempts have been made to discover this passage, by sailing along the western coast of America; but hitherto none of them has been crowned with success. So early as 1579, Sir Francis Drake assured Queen Elizabeth that he had sailed some leagues up the straits of Anian (see ANIAN), and discovered New Albion, to the north of California; but the strait is now known to have no existence; and Drake's real discoveries were not improved. In 1638, King Charles I. sent Captain Luke Fox in one of his pinnaces to attempt the passage; but of his proceedings we know nothing, but that he reached Port Nelson in Hudson's bay, where he found some remains of former navigators. Next year Captain James was fitted out by the merchants of Bristol for the same purpose. James was one of the ablest navigators that ever sailed from England or any other country; and his voyages to the north were printed in 1633. After all the experiments he had made, he concluded that there was no such passage; or if there be, he affirmed that the discovery of it would not be attended with those advantages which are commonly expected. His reasons, however, for these opinions have been answered, and many subsequent attempts have been made to perform what he thought impossible. The arguments for a north-west passage were so plausible, that, in 1744, an act of parliament was passed to encourage the discovery of it. Among many others, Captain Cook attempted the discovery in vain, and thence adopted James's opinion. (See *Cook's Discoveries*, N° 103.) This celebrated navigator, after having proceeded northwards to the western extremity of America, and ascertained the proximity of the two great continents of Asia and America, returned to the Sandwich islands, firmly persuaded of the impracticability of a passage in that hemisphere from the Atlantic into the Pacific ocean, either by an eastern or a western course.

Later voyagers, however, have pretended to detect some errors in Cook's discoveries and the author of a small tract, entitled *An authentic Statement of all the Facts relative to Nootka Sound*, goes a great way to make the discovery not yet hopeless. In his account of the expedition under the direction of Messrs Etches, he says, that "one of the first discoveries made by these ships was, that what was by the immortal Cook laid down as a continuation of the north-west continent of America, and lying between the northern latitudes of 48 and 57, is on the contrary an extensive cluster of unexplored islands inhabited by numerous tribes of friendly Indians, with whom a regular connexion was formed."

These islands they discovered, contrary to the assertion of Captain Cook, to conceal the opening of a vast inland sea, or archipelago, in all probability equal to the Mediterranean or Baltic seas, and dividing the great northern continent of America. The Princess Royal penetrated some hundred leagues among them, in a north-east course, to within 200 leagues of Hudson's house, but had not then an opportunity to explore the extreme termination of that archipelago, their commercial concerns obliging them to return to the China market; but the commanders had the strongest reasons to believe, had the time favoured their survey, that they should have been able to discover the long wished for passage between the Atlantic and South sea. They conceived, that should neither the inland arm of the sea through which the Princess Royal penetrated, nor a large strait named Sir Charles Middleton's about three degrees to the southward, be found to reach across the continent, yet that the land barrier must be very inconsiderable; and that at the extremity of this bay a practicable passage, either by rivers or lakes, will, by perseverance, be found terminating towards Hudson's bay.

Upon the whole, however, it appears to us extremely doubtful whether there be such a passage; but it is much more likely to be discovered, if discovered at all, by the progressive advances of mercantile enterprise than by any immediate expedition undertaken for that purpose.

North-east Passage.

*NORTH-East Passage*, a passage to the East Indies along the northern coasts of Asia, which, like the former, hath frequently been attempted, but hitherto without success. The first attempt was made in 1553, by Sir Hugh Willoughby, who commanded three ships. He departed from the Thames and sailed to the North Cape, where one of his ships left him, and returned home. The other two ships being separated, Sir Hugh proceeded farther northward, and discovered that part of Greenland which the Dutch have since called *Spitsberg*; but the severity of the cold obliging him to return to the southward, he was forced, by bad weather, into the river Arzina, in Muscovite Lapland, where, not being able to come out, he was found the next spring frozen to death, with all his ship's company; having the notes of his voyage and his last will lying before him, whereby it appeared that he lived till January. But Richard Chancellor, in the third ship, with better success, in the meanwhile entered Wardhuys, where he waited some time for his companions to no purpose; uncertain whether they were lost, or driven farther by stress of weather. He held a council on what he should do; whether to return,

North-east Passage. return, or pursue his voyage. Whatever danger might be in the last, every one agreed to it, that they might not seem to have less courage than their captain. They therefore set sail, and in a few days found themselves in a sea where they could no longer perceive any night. This ship, wandering about, entered soon after into a large bay or gulf. Here they cast anchor, in sight of land; and while they were examining the coast, they discovered a fishing boat. Chancellor getting into his sloop, went towards it; but the fishermen took to flight. He followed, and, overtaking them, showed them such civilities as conciliated their affections to him; and they carried him to the place where now is the famous port of St Michael the Archangel. These people immediately spread through all the coasts an account of the arrival of those strangers; and people came from several parts to see them, and ask them questions. They, in their turn, examined the others, and found that the country they were in was Russia, governed by the mighty emperor John Basilowitz. Chancellor from Archangel travelled on sledges to the Czar at Moscow; from whom, overjoyed at the prospect of opening a maritime commerce with Europe, he obtained privileges for the English merchants, and letters to King Edward VI. who was not, however, alive to receive them.

In 1585, Mr John Davis in two barks discovered Cape Desolation, which is supposed to be part of Greenland; and two years after advanced as far as Lat. 72°, where he discovered the strait which still bears his name. To enumerate all the attempts which have been made to discover a north-east passage, would swell the article to very little purpose. The English, Dutch, and Danes, have all attempted it without success. The last voyage from England for this purpose was made in 1676, under the patronage of the duke of York. That unfortunate prince, who was on all occasions earnest for the promotion of commerce, and the Lord Berkeley, &c. fitted out a ship, commanded by Captain Wood, for an attempt once more to find a north-east passage to India, accompanied with a ship of the king's. They were encouraged to this attempt, after it had been so long despaired of, by several new reports and reasonings: some of which seem not to have been very well grounded—As,

"1. On the coast of Corea, near Japan, whales had been found with English and Dutch harpoons sticking in them. This is no infallible proof that ships could get thither by a north-east passage, although whales might.

"2. That, 20 years before, some Dutchmen had sailed within one degree of the north pole, and found it temperate weather there: and that therefore William Barents, the Dutch navigator who wintered at Nova Zembla in the year 1596, should have sailed further to the north before turning eastward; in which case, said they, he would not have found so much obstruction from the ice.

"3. That two Dutch ships had lately sailed 300 leagues to the eastward of Nova Zembla; but their East India Company had stifled that design, as against their interest:—and such like other airy reports. But this attempt proved very unfortunate. They doubled the North Cape, and came among much ice and drift wood, in 76° of north latitude, steering to the coast of Nova Zembla, where the king's ship struck upon the rocks, and was soon beat to pieces; and Captain Wood returned home with an opinion, "that such a passage was utterly impracticable, and that Nova Zembla is a part of the continent of Greenland."

These passages, however, are not yet deemed impracticable at all. The Count de Buffon holds it for certain, that there is a passage from Europe to China by the north sea. The reason why it has been so often attempted in vain, he thinks, is, that fear prevented the undertakers from keeping at a sufficient distance from land, and from approaching the pole, which they probably imagined to be an immense rock. Hence he affirms, that if any farther attempts be made to find a passage to China and Japan by the north seas, it will be necessary to keep at a distance from the land and the ice; to steer directly towards the pole; and to explore the most open seas, where unquestionably, says he, there is little or no ice. This opinion has been lately revived by the Hon. Daines Barrington, who says, that if the passage be attempted by the pole itself, he has very little doubt of its being accomplished. See *North-Pole.*

Northampton. NORTHAMPTON, a town in England, capital of a county of the same name, situated in W. Long. 0. 55. N. Lat. 52. 15. According to Camden, it was formerly called *North-afandon*, from its situation to the north of the river Nen, called anciently *Aufona*, by which and another lesser river it is almost enclosed. Dr Gibson says, that the ancient Saxon annals called both it and Southampton simply *Hamton*; and afterwards, to distinguish them, called the one, from its situation, *Southamton*, and the other *Northamton*; but never *North-afandon*. Though it does not appear to be a place of very great antiquity, nor to have emerged from obscurity till after the Conquest, it has sent members to parliament since the reign of Edward I. and being in the heart of the kingdom, several parliaments have been held at it. There was also a castle, and a church dedicated to St Andrew, built by Simon de Sancto Licio, commonly called *Senlez*, the first earl of Northampton of that name. It is said to have been burnt down during the Danish depredations; but in the reign of St Edward it appears to have been a considerable place. It was besieged by the barons in their war with King John; at which time that military work called *Hunsbill*, is supposed to have been raised. In the time of Henry III. it sided with the barons, when it was besieged and taken by the king. Here the bloody battle was fought in which Henry VI. was taken prisoner. It was entirely consumed by a most dreadful fire in 1675; yet, by the help of liberal contributions from all parts of the country, it hath so recovered itself, that it is now one of the neatest and best built towns of the kingdom. Among the public buildings which are all lofty, the most remarkable are the church called *All-hallows* (which stands at the meeting of four spacious streets), the sessions and assize house, and the George inn, which belongs to the poor of the town. A county hospital or infirmary has been lately built here, after the manner of those of Bath, London, Bristol, &c. It has a considerable manufacture of shoes and stockings; and its

fairs

fairs are noted for horses both for draught and saddle; besides, it is a great thoroughfare for the north and west roads. It was formerly walled, and had seven churches within and two without. The horse market is reckoned to exceed all others in the kingdom, it being deemed the centre of all its horse markets and horse fairs, both for saddle and harness, and the chief rendezvous of the jockies both from York and London. Its principal manufacture is shoes, of which great numbers are sent beyond sea; and the next to that, stockings and lace, as we have hinted at above. It is the richer and more populous, by being a thoroughfare both in the north and west roads; but, being 80 miles from the sea, it can have no commerce by navigation. The walls of this town were above two miles in compass. It is supposed to contain about 1083 houses, and 5200 inhabitants. It had formerly a nunnery in the neighbouring meadows, with several other monasteries; and of its very old castle on the west side of the town, a small part of the ruins are still to be seen. Some discontented scholars came hither from Oxford and Cambridge, about the end of the reign of Henry III. and, with the king's leave, prosecuted their studies here academically for three years; during which there was the face of an university, till it was put a stop to by express prohibition, because it was a damage to both universities. The public horse races are on a neighbouring down, called *Pye-Leys*. In and about the town are abundance of cherry gardens. Within half a mile of the town is one of the crosses erected by King Edward I. in memory of his queen Eleanor, whose corpse was rested there in its way to Westminster. On the north side of the river, near that cross, many Roman coins have been ploughed up. At Guilesborough, north-west of Northampton, are to be seen the vestiges of a Roman camp, the situation of which is the more remarkable, as lying between the Nen and the Avon, the only pass from the north to the south parts of England not intercepted by any river. This camp was secured only by a single intrenchment, which was, however, very broad and deep.

NORTHAMPTONSHIRE, a county of England, is situated in the very heart of the kingdom: bounded on the east by the counties of Bedford and Huntingdon; on the south by those of Buckingham and Oxford; on the west by Warwickshire; and on the north by the counties of Leicester, Rutland, and Lincoln, which are separated from it by the Lesser Avon, and the Welland. Its greatest length is about 50 miles, its greatest breadth about 20, and its circumference about 130. It contains 330 parishes. There are in it one city, 11 market towns, 25,000 houses, and 150,000 inhabitants. Nine members are returned to parliament for this county, viz. two knights for the shire, two for the city of Peterborough, two for each of the towns of Northampton and Brockly, and one for Higham Ferrers. It lies in the mid-land circuit, and in the diocese of Peterborough. As this county is dry, well cultivated, free from marshes, except the fens about Peterborough, in the centre of the kingdom, and of course at a distance from the sea, it enjoys a very pure and wholesome air. In consequence of this it is very populous, and so full of towns and churches, that 30 spires or steeples may be seen in many places at one view: and even in the fens, the inhabitants seem to enjoy a good state of health, and to be little affected by the water which frequently overflows their grounds, especially in winter, but is never suffered to remain long upon it. Its soil is exceeding fertile both in corn and pasturage; but it labours under a scarcity of fuel, as it doth not produce much wood, and, by lying at a distance from the sea, cannot be easily supplied with coal. Its commodities, besides corn, are sheep, wool, black cattle, and saltpetre; and its manufactures are serges, tammies, shalloons, boots, and shoes. Besides many lesser brooks and streams, it is well watered by the rivers Nen, Welland, Ouse, and Leam; the three first of which are large, and for the most part navigable.

NORTHAMPTON, a county of North America, in Virginia, forming the south part of the peninsula on the eastern coast of Virginia.

NORTH ROCKS, (otherwise called *St Patrick's rocks*, from a seat of stone amongst them called *St Patrick's chair*, whence the rocks have taken this second name; situated in the harbour of Donaghadee, in the county of Down, and province of Ulster, in Ireland. From north to south they are about two thirds of a league, between which is clean good ground. But care must be taken of the south rock, on which many ships have perished: for it is overflowed by every tide, and no crew can save their lives if the wind blows high. This rock stands a full mile from the shore.

NORTH SEA. See *North Sea*.

NORTHERN LIGHTS, the same with AURORA BOREALIS, under which article we have given a copious account of this phenomenon, and of the supposed causes of it. Natural science, however, does not arrive at perfection at once, and it is well if it does so after trials repeated for years with care and accuracy. How far the causes that have been assigned for this appearance will account for it, or whether they will be able to remove all difficulties, it is not for us to determine; but it is the part of philosophers to hear all sides, and to attend with patient assiduity to every hypothesis, rejecting or receiving as reason, after the strictest investigation, shall seem to favour the one side or the other. Wishing to lay before our readers every thing important either in science or in literature, we cannot let pass the opportunity which the present article affords us, of mentioning a hypothesis which Doctor Stearns, an American, formed, about the year 1788, to account for the appearances called *aurora borealis*, and *aurora australis*. For this last, see AURORA BOREALIS, N° 3.

Doctor Stearns supposes that these phenomena originate from aqueous, nitrous, sulphureous, bituminous, and other exhalations, from the fumes of various kinds of earths or other minerals, vegetables, animals, fires, volcanoes, &c. These, he thinks, become rarefied, and being charged with electrical fluid, become specifically lighter than the circumambient air; hence, of course, they ascend; and being elevated to the upper regions of the air, and driven by the winds from warmer to colder climates, the cold makes them combine and stiffen. When they are afterwards agitated by different currents of air, they sparkle and crackle like the hairs of cats and other animals when stiffened with cold. This coruscation in quite cold atmospheres,

spheres, and in those which are more temperate, appears in different positions in the horizon, zenith, or otherwise, according to the situation of the spectator, and the position of the elevated exhalations. The difference of colours the Doctor supposes to arise from the different qualities of the articles combined, those of the most inflammable nature shining with the greatest lustre.

The Doctor likewise tries to account for these lights not appearing, or but seldom appearing, in ancient times. The atmosphere, he thinks, was not impregnated with materials proper to produce them. He imagines that the increased consumption of fuel, in America in particular, the burning of volcanoes, and the approach of blazing stars, whose atmospheres have been so expanded by the sun's heat that part of them have fallen into the earth's atmosphere, and communicated to it new matter, have so changed and prepared our air, that whenever its consistence is proper, then, if the light of the sun and moon is not too powerful, the aurora borealis will appear.

NORTHUMBERLAND, the most northerly county of England, and formerly a distinct kingdom, is bounded on the north and west by the river Tweed, which divides it from Scotland, the Cheviot hills, and part of Cumberland; washed on the east by the German ocean; and separated from Durham on the south by the rivers Tyne and Derwent. This county, which gives the title of *duke* to a nobleman who married the daughter of Algernon duke of Somerset, whose mother was heiress of the Piercy family, extends about 66 miles in length from north to south, and about 47 in breadth from east to west. It is remarkably populous, containing 12 market towns, 280 villages, and 460 parishes. The face of the country, especially towards the west, is roughened with huge mountains, the most remarkable of which are the Cheviot hills, and the high ridge called *Ridesdale*; but the lands are level towards the sea side and the borders of Durham. The climate, like that of every other mountainous country in the neighbourhood of the sea, is moist and disagreeable: the air, however, is pure and healthy, as being well ventilated by breezes and strong gales of wind; and in winter mitigated by the warm vapours from the two seas, the Irish and the German ocean, between which it is situated. The soil varies in different parts of the county. Among the hills it is barren; though it affords good pasture for sheep, which cover those mountains. The low country, when properly cultivated, produces plenty of wheat, and all sorts of grain; and great part of it is laid out in meadow lands and rich enclosures. Northumberland is well watered with many rivers, rivulets, and fountains: its greatest rivers are the Tweed and the Tyne. The Tyne is composed of two streams called *South* and *North Tyne*: the first rises on the verge of Cumberland, near Alston Moor; enters Northumberland, running north to Haltwesel; then bends easterly, and receiving the two small rivers East and West Alon, unites above Hexham with the other branch, taking its rise at a mountain called *Fane-head* in the western part of the county, thence called *Tine-dale*; is swelled in its course by the little river Shele; joins the Read near Billingham; and running in a direct line to the south-east, is united with the southern Tyne, forming a large river that washes Newcastle, and falls into the German ocean near Tinmouth.

In all probability the mountains of Northumberland contain lead ore and other mineralized metals in their bowels, as they in all respects resemble those parts of Wales and Scotland where lead mines have been found and prosecuted. Perhaps the inhabitants are diverted from inquiries of this nature, by the certain profits and constant employment they enjoy in working the coal pits, with which this county abounds. The city of London and the greatest part of England, are supplied with fuel from these stores of Northumberland, which are inexhaustible, enrich the proprietors, and employ an incredible number of hands and shipping. About 658,858 chaldrons are annually shipped for London.

There are no natural woods of any consequence in this county; but many plantations belonging to the seats of noblemen and gentlemen, of which here is a great number. As for pot herbs, roots, salading, and every article of the kitchen garden and orchard, they are here raised in great plenty by the usual means of cultivation; as are also the fruits of more delicate flavour, such as the apricot, peach, and nectarine. The spontaneous fruits it produces in common with other parts of Great Britain, are the crab-apple, the sloe or bullace, the hazel nut, the acorn, hips, and haws, with the berries of the bramble, the juniper, wood strawberries, cranberries, and bilberries.

Northumberland raises a good number of excellent horses and black cattle, and affords pasture for numerous flocks of sheep; both the cattle and sheep are of a large breed, but the wool is coarser than that which the more southern counties produce. The hills and mountains abound with a variety of game, such as red deer, foxes, hares, rabbits, heathcock, grouse, partridge, quail, plover, teal, and woodcock: indeed, this is counted one of the best sporting counties in Great Britain. The sea and rivers are well stocked with fish; especially the Tweed, in which a vast number of salmon is caught and carried to Tinmouth, where being pickled, they are conveyed by sea to London, and sold under the name of *Newcastle Salmon*.

The Northumbrians were anciently stigmatized as a savage, barbarous people, addicted to cruelty, and inured to rapine. The truth is, before the union of the two crowns of England and Scotland, the borderers on each side were extremely licentious and ungovernable, trained up to war from their infancy, and habituated to plunder by the mutual incursions made into each kingdom; incursions which neither truce nor treaty could totally prevent. People of a pacific disposition, who proposed to earn their livelihood by agriculture, would not on any terms remain in a country exposed to the first violence of a bold and desperate enemy; therefore the lands lay uncultivated, and in a great measure deserted by every body but lawless adventurers, who subsisted by theft and rapine. There was a tract 50 miles in length and 6 in breadth, between Berwick and Carlisle, known by the name of the *Debateable Land*, to which both nations laid claim, though it belonged to neither; and this was occupied by a set of banditti who plundered on each side, and what they stole in one kingdom, they sold openly in the other:

Northumberland, Northwick.

nay, they were so dexterous in their occupation, that by means of hot bread applied to the horns of the cattle which they stole, they twisted them in such a manner, that, when the right owners saw them in the market, they did not know their own property. Wardens were appointed to guard the marches or borders in each kingdom; and these offices were always conferred on noblemen of the first character for influence, valour, and integrity. The English border was divided into three marches, called the *east*, *west*, and *middle marches*; the gentlemen of the country were constituted deputy wardens, who held march-courts, regulated the watches, disciplined the militia, and took measures for assembling them in arms at the first alarm: but in the time of peace between the two nations, they were chiefly employed in suppressing the insolence and rapine of the borderers. Since the union of the crowns, however, Northumberland is totally changed, both with respect to the improvement of the lands, and the reformation of the inhabitants. The grounds, being now secure from incursion and insult, are settled by creditable farmers, and cultivated like other parts of the kingdom. As hostilities have long ceased, the people have forgot the use of arms, and exercised themselves in the more eligible avocations of peace; in breeding sheep and cattle, manuring the grounds, working at the coal pits, and in different branches of commerce and manufacture. In their persons they are generally tall, strong, bold, hardy, and fresh coloured; and though less unpolished than their ancestors, not quite so civilized as their southern neighbours. The commonalty are well fed, lodged, and clothed; and all of them remarkably distinguished by a kind of *shibboleth* or *wburle*, being a particular way of pronouncing the letter *R*, as if they hawked it up from the windpipe, like the cawing of rooks. In other respects, the language they speak is an uncouth mixture of the English and Scottish dialects. There is no material distinction between the fashionable people of Northumberland and those of the same rank in other parts of the kingdom; the same form of education will produce the same effects in all countries. The gentlemen of Northumberland, however, are remarkable for their courage, hospitality, and hard drinking. The number of inhabitants is reckoned 126,400, of houses 22,740.

A great number of Roman monuments have been found in this county; but the most remarkable curiosity of that kind consists in the remains of Hadrian's vallum and the wall of Severus. See *Adrian*, note (A), and *Severus's Wall*.

The most noted towns in Northumberland, are Newcastle, Morpeth, Alnwick, Berwick, Hexham, and North Shields. It sends two members to parliament.

NORTHWICK, a small town of Cheshire, long celebrated for its rock salt and brine pits. The stratum of salt lies about 40 yards deep; and some of the pits are hollowed into the form of a temple. The descent is through a dome, the roof supported by rows of pillars about two yards thick, and several in height; and when illuminated with a sufficient number of candles, they make a most magnificent appearance. Above the salt is a bed of whitish clay (*Argilla cerula-cinerea*), used in making the Liverpool earthen ware; and in the same place is also dug a good deal of the gypsum, or plaster stone. The fossil salt is generally yellow, and semipellucid, sometimes debased with a dull greenish earth; and is often found, but in small quantities, quite clear and colourless. The town is situated near the river Dane, and is tolerably handsome: it has a market on Fridays. It is 20 miles north-east of Chester, and 173 north-west of London. W. Long. 2. 36. N. Lat. 53. 16.

Norton || Norway.

NORTON, in Cheshire, a good modern alms house, founded by P—y Brooke, Esq; on the site of a priory of canons regular of St Augustine, founded by William, son of Nigellus, A. D. 1135, who did not live to complete his design; for Eustace de Burgaville granted to Hugh de Catherine pastures for 100 sheep, in case he finished the church in all respects conformable to the intent of the founders. It was granted afterwards to R. Brooke, Esq.

NORTON'S SOUND, was discovered in Capt. Cook's last voyage, and was so named in honour of Sir Fletcher Norton (Lord Grantley), a near relation of Mr, afterwards Dr, King. It extends as far as N. Lat. 64° 55'. There is no good station for ships, nor even a tolerable harbour in all the sound. Mr King, on his landing here, discerned many spacious valleys, with rivers flowing through them, well wooded, and bounded with hills of a moderate height. One of the rivers towards the north-west seemed to be considerable; and he was inclined to suppose, from its direction, that it discharged itself into the sea from the head of the bay. Some of his people, penetrating beyond this into the country, found the trees to be of a larger size the farther they proceeded. E. Long. 197. 13. N. Lat. 64. 31.

NORWAY, a country of Europe (for the map see Denmark), lying between the 57th and 72d degrees of north latitude, and between the 5th and 31st degrees of longitude east from London; extending in length about 1000 miles, in a direct line from Lindesnaes, in the diocese of Christiansand, to the North Cape, at the extremity of Finmark. Its breadth, from the frontiers of Sweden westward to Cape Statt, may amount to about 300 miles; but from thence the country becomes gradually narrower towards the north. On the south it is bounded by the Schagen rock, or Categate, the entrance into the Baltic; on the east it is divided from Sweden by a long ridge of high mountains; and on the west and north it is washed by the northern ocean. In the southern part of Norway, the country is craggy, abrupt, and mountainous, diversified sometimes with fertile and even delightful spots. In these respects it resembles Switzerland: the prospects and the meteorological phenomena seem to be very similar. The range of the thermometer is of great extent; in the summer having risen to 88°, and in the winter fallen to —40°: in general it is between 80° and —22°.

Respecting the population of Norway it is difficult to attain to certainty. An author of some note (Coxe) seems to think it amounts to 750,000; but he appears to have over-rated it considerably.

The Norwegian peasants are free, well clothed, well lodged, [illegible] frank, open, and undaunted. They [illegible] very considerable resemblance to the peasants of Switzerland. The soil is too thin for

Norway.

for the plough: corn is therefore obtained from the neighbouring states; and the chief employment of the peasants of Norway is grazing. The following extract from Mr Coxe, being a description of the scene near Christiana, is not beside our purpose, and may not perhaps be disagreeable to our readers.

*Coxe's Travels.*

"As we approached Christiana, the country was more wild and hilly, but still very fertile and agreeable; and about two miles from the town we came to the top of a mountain, and burst upon as fine a view as ever I beheld. From the point in which we stood in raptures, the grounds laid out in rich enclosures, gradually sloped to the sea; below us appeared Christiana, situated at the extremity of an extensive and fertile valley, forming a semicircular bend along the shore of a most beautiful bay, which, being enclosed by hills, uplands, and forests, had the appearance of a large lake. Behind, before, and around, the inland mountains of Norway rose on mountains covered with dark forests of pines and fir, the inexhaustible riches of the north. The most distant summits were caped with eternal snow. From the glow of the atmosphere, the warmth of the weather, the variety of the productions, and the mild beauties of the adjacent scenery, I could scarcely believe that I was nearly in the 60th degree of northern latitude."

The coast of Norway, extending above 300 leagues, is studded with a multitude of small islands, affording habitation to fishermen and pilots, and pasture to a few cattle. They form an infinite number of narrow channels, and a natural barrier of rocks, which renders Norway inaccessible to the naval power of its enemies. Attempts of this kind are the more dangerous, as the shore is generally bold, steep, and impending; so that close to the rocks the depth of the sea amounts to 100, 200, or 300 fathoms. The perils of the north sea are moreover increased by sudden storms, sunk rocks, violent currents, and dreadful whirlpools. The most remarkable vortex on this coast is called *Moskoestrom*, from the small island Moskoe, belonging to the district of Lofoden in the province of Nordland. In time of flood, the stream runs up between Lofoden and Moskoe with the most boisterous rapidity; but in its ebb to the sea, it roars like a thousand cataracts, so as to be heard at the distance of many leagues. The surface exhibits different vortices; and if in one of these any ship or vessel is absorbed, it is whirled down to the bottom, and dashed in pieces against the rocks. These violent whirlpools continue without intervals, except for a quarter of an hour, at high and low water, in calm weather; for the boiling gradually returns as the flood or ebb advances. When its fury is heightened by a storm, no vessel ought to venture within a league of it. Whales have been frequently absorbed within the vortex, and howled and bellowed hideously in their fruitless endeavours to disengage themselves. A bear, in attempting to swim from Lofoden to Moskoe, was once hurried into this whirlpool, from whence he struggled in vain for deliverance, roaring so loud as to be heard on shore; but notwithstanding all his efforts, he was borne down and destroyed. Large trees being absorbed by the current are sucked down, and rise again all shattered into splinters. There are three vortices of the same kind near the islands of Ferroe.

Norway is divided into the four governments of Aggerhus, Bergen, Drontheim, and Wardhus, besides that of Bahus, which is now subject to Sweden. The province of Aggerhus comprehends the south-east part of Norway, extending in length about 300 miles. Its chief towns are Christiana, the see of a bishop, suffragan to the metropolitan see of Drontheim, where the supreme court of justice is held, in presence of the viceroy and the governor of the province; Aggerhus, about 15 miles to the south-west of Christiana; Frederickshall or Frederickstadt, in the siege of which Charles XII. of Sweden lost his life: Saltzberg, Tonsberg, Alleen, Hammar, and Hollen.

The government of Bergen lies in the most southerly and westerly part of Norway, including the city of the same name, which is an episcopal see, and a place of considerable trade; and Staff-hanger, situated in the bay of Buckensior, about 80 miles to the southward of Bergen. The third province, called *Drontheim* or *Trontheim*, extends about 500 miles along the coast; and is but thinly peopled. The chief town Drontheim, seated on a little gulf at the mouth of the river Nider, is the only metropolitan see in Norway; and carries on a considerable trade in masts, deals, tar, copper, and iron. Leetstrand, Stronden, Scoerdale, Opdal, Romsdael, and Solendael, are likewise places of some traffic. The northern division of Drontheim, called the *sub-government of Salten*, comprehends the towns Melanger and Scheen. The province of Wardhus, extending to the North Cape, and including the islands, is divided into two parts; namely, Finmark and Norwegian Lapland. The chief town, which is very inconsiderable, stands upon an island called *Ward*, from whence the place and the government derive their name. The province of Bahus, though now yielded to the Swedes, is reckoned part of Norway, being a narrow tract of land, about 90 miles in length, lying on the coast of the Categate.

The great chain of Norway mountains, running from north to south, called indifferently *Rudfield*, *Sudfield*, *Skarsfield*, and *Scoreberg*, is known in different parts by other appellations; such as *Dofrefull*, *Lamfield*, *Sagnifield*, *Filefield*, *Halnefield*, *Hardangerfield*, *Joklefield*, *Byglefield*, *Hicklefield*, and *Hangfield*. The height and breadth of this extensive chain likewise vary in different parts. To pass the mountain Hardanger, a man must travel about 70 English miles, whereas Filefield may be about 50 over. This last rises about two miles and a half in perpendicular height; but Dofrefield is counted the highest mountain of Norway, if not of Europe. The river Drivane winds along the side of it in a serpentine course, so as to be met nine times by those who travel the winter road to the other side of the chain. The bridges are thrown over roaring cataracts, and but indifferently fastened to the steep rocks on either side; so that the whole exhibits a very dreadful appearance, sufficient to deter the traveller from hazarding such a dangerous passage; for which reason, people generally choose the road over Filefield, which is much more tedious. This, however, is the post road used by the king's carriages. The way is distinguished by posts fixed at the distance of 200 paces from each other, that, in snowy or dark weather, the traveller may not be be-

Norway. wildered. For the convenience of resting and refreshing, there are two mountain stoves or houses maintained on Filefield, as well as upon other mountains, at the expence of the public, and furnished with fire, light, and kitchen utensils. Nothing can be more dismal and dreary than those mountains covered with eternal snow, where neither house, tree, nor living creature is to be seen, but here and there a solitary rein deer, and perchance a few wandering Laplanders.

In travelling from Sweden to Nordenfields, there is only one way of avoiding this chain of mountains; and that is, where it is interrupted by a long deep valley, extending from Romsdale to Guldbrandsdale. In the year 1612, a body of 1000 Scots, commanded by Sinclair, and sent over as auxiliaries to the Swedes, were put to the sword in this defile, by the peasants of Guldbrand, who never give quarter.

Besides this chain, there is a great number of detached mountains over all the country, that form valleys and ridges, inhabited by the peasants. Some of these are of incredible height, and others exhibit very remarkable appearances. In sailing up Joering Creek on the left hand, the sight is astonished with a group of mountains, resembling the prospect of a city, with old Gothic towers and edifices. In the parish of Oerskong is the high mountain Skopshorn, the top of which represents the figure of a fortification, with regular walls and bastions. In the district of Hilgeland appears a very high range of mountains, with seven pinnacles or crests, known by the appellation of the *Seven Sisters*, discernible a great way off at sea. To the southward of this range, though in the same district, rises the famous mountain *Torghatten*, so called because the summit resembles a man's head with a hat on, under which appears a single eye, formed by an aperture through the mountain, 150 ells high, and 3000 ells in length. The sun may be seen through this surprising cavity, which is passable by the foot of travellers. On the top of the mountain we find a reservoir of water, as large as a moderate fish pond: in the lower part is a cavern, through which a line 400 fathoms in length, being let down, did not reach the bottom. At Herroe in Sundmoer is another cavern called *Dolsteen*, supposed to reach under the sea to Scotland; which, however, is no more than an idle tradition. In the year 1750, two clergymen entered this subterranean cavity, and proceeded a considerable way, until they heard the sea dashing over their heads: the passage was as wide and high as an ordinary church, the sides perpendicular, and the roof vaulted. They descended one flight of natural stairs; but arriving at another, they were afraid to penetrate farther: they had gone so far, however, that two candles were consumed in their progress and return. A cavern of a very curious nature, serving as a conduit to a stream of water, penetrates through the sides of the mountain Limur. In the district of Rake, in the neighbourhood of Frederickshall, are three cavities in a rock; one of which is so deep, that a small stone dropped down, does not reach the bottom in less than two minutes; and then the sound it produces is pleasant and melodious, not unlike the sound of a bell.

The vast mountains and rugged rocks that deform the face of this country are productive of numberless inconveniences. They admit of little arable ground: they render the country in some parts impassable, and everywhere difficult to travellers: they afford shelter to wild beasts, which come from their lurking holes, and make terrible havock among the flocks of cattle: they expose the sheep and goats, as well as the peasant, to daily accidents of falling over precipices: they occasion sudden torrents, and falls of snow, which descend with incredible impetuosity, and often sweep away the labours of the husbandman; and they are subject to dreadful disruptions, by which huge rocks are sent from their sides, and, hurling down, overwhelm the plains below with inevitable ruin. The peasants frequently build their houses on the edge of a steep precipice, to which they must climb by ladders, at the hazard of their lives; and when a person dies, the corpse must be let down with ropes, before it can be laid in the coffin. In winter the mail is often drawn up the sides of steep mountains. Even in the king's road, travellers are exposed to the frequent risks of falling over those dreadful rocks; for they are obliged to pass over narrow pathways, without rails or rising on the sides, either shored up with rotten posts, or suspended by iron bolts fastened in the mountains. In the narrow pass of Naeroe is a remarkable way of this kind, which, above 600 years ago, the famous King Surre caused to be made for the passage of his cavalry; and even this would have been found impassable by any other horses than those of Norway, which are used to climb the rocks like goats. Another very difficult and dangerous road is that between Shogstadt and Vang-in-Volders, along the side of a steep mountain, in some places so narrow, that if two travellers on horseback should meet in the night, they would find it impracticable either to pass each other, or turn back. In such a case their lives could not be saved, unless one of them should alight, and throw his horse headlong into the lake below, and then cling to the rock, until the other could pass. When a sheep or goat makes a false step to the projection of a rock, from whence it can neither ascend nor descend, the owner hazards his own life to preserve that of the animal. He directs himself to be lowered down from the top of the mountain, sitting on a cross stick, tied to the end of a long rope; and when he arrives at the place where the creature stands, he fastens it to the same cord, and it is drawn up with himself. Perhaps the other end of the rope is held by one person only; and there are some instances in which the assistant has been dragged down by the weight of his friend, so that both have perished. When either man or beast has had the misfortune to fall over very high precipices, they have not only been suffocated by the repercussion of the air, but their bodies have been always burst before they reached the ground. Sometimes entire crests of rocks, many fathoms in length and breadth, have fallen down at once, creating such a violent agitation of the air, as seemed a prelude to the world's dissolution. At Steenbroe in Laerdale, a stupendous mass, larger than any castle in the universe, appears to have been severed and tumbled from the mountain in large, sharp, and ragged fragments, through which the river roars with hideous bellowing. In the year 1731, a promontory on Sundmoer, called *Rammersfield*, that hung

Norway. hung over Nordal Creek, suddenly gave way, and plunged into the water; which swelled to such a degree, that the church of Strand, though half a league on the other side of the bank, was overflowed: the creek, however, was not filled up; on the contrary the fishermen declare they find no difference in the depth, which is said to exceed 900 fathoms.

The remarkable rivers of Norway are these: The Nied, issuing from Tydalen, on the borders of Sweden, runs westward into the lake Selboe; and afterwards, turning to the northward, passes by the city of Drontheim, to which it anciently gave the name of *Nidaros* and *Nidrosia*: Sule Ely, that descending from Sulefield, runs with a rapid course through Nordale into the sea: Gulen, which rises near Sffarsfield in the north; and running 20 leagues westward, through Aalen, Hlotaalen, Storen, and Melhuus, discharges itself into the sea, about a league to the west of Drontheim. In the year 1344, this river buried itself under ground: from whence it again burst forth with such violence, that the earth and stones thrown up by the eruption filled the valley, and formed a dam; which, however, was soon broken and washed away by the force of the water. Divers churches, 48 farm houses, with 250 persons, were destroyed on this occasion.—Otteroen, a large river, taking its rise from the mountain Agde, runs about 30 leagues through Seeterdale and Esie, and disembogues itself into the cataract of Wiland. The river Syre rises near the mountain Lang, and winds its course through the vale of Syre into the lake of Lunde in the diocese of Christiansand; thence it continues its way to the sea, into which it discharges itself through a narrow strait formed by two rocks. This contraction augments its impetuosity, so that it shoots like an arrow into the sea, in which it produces a very great agitation. Nid and Sheen are two considerable rivers, issuing out of Tillemark. Their water-falls have been diverted, with infinite labour, by canals and passages cut through the rocks, for the convenience of floating down the timber. Tyrefiord or Dramme, is in the neighbourhood of Honifosse, joined by two rivers from Oedale and Hadeland, and disembogues itself into the sea near Bragness. Loven rises in the highest part of Nummedal, and runs through Konsberg to the sea near Laurwig. Glaamen is the largest river of Norway, distinguished by the name of *Stor Elvin*, or the *great river*. It derives its origin from the mountain Dofre, from whence it winds all along the plains of Oesterdale and Soloe; then joins the Vorme, another considerable river rising out of Mioes and Guldbrandsdale. These being joined, traverse the lake Oeyeren; and thence issuing, run on to Sarp near Frederickstadt.

Norway abounds with fresh water lakes; the principal of which are Rysvand in Nordland, Snaasen, Selboe, the Greater and Lesser Mioes, Slirevand, Sperdille, Rand, Vestn, Saren, Modum, Lund, Norsoe, Huidsoe, Farisvand, and Oeyevand: all these are well stocked with fish, and navigable for large vessels. Wars have been formerly carried on upon these inland seas; in some of which are small floating islands, or parcels of earth, with trees on them, separated from the main land, and probably preserved in compact masses by the roots of trees, shrubs, and grass, interwoven in the soil. In the year 1702, the family seat of Borge, near Frederickstadt, being a noble edifice, with lofty towers and battlements, suddenly sunk into an abyss 100 fathoms deep, which was instantaneously filled by a piece of water 300 ells in length and about half as broad. Fourteen persons, with 200 head of cattle, perished in this catastrophe, which was occasioned by the river Glaamen precipitating itself down a water-fall near Sarp, and undermining the foundation. Of all the water-falls in Norway this of Sarp is the most dangerous for its height and rapidity. The current drives 17 mills; and roars with such violence, that the water, being dashed and comminuted among the rocks, rises in the form of dust, where a beautiful rainbow may be always seen when the sun shines. In ancient times this cataract was made use of for the execution of traitors and other malefactors: they were thrown down alive, that they might be dashed in pieces on the points of rocks, and die in a dreadful commotion, analogous to those they had endeavoured to excite in the community.

Great part of Norway is covered with forests of wood, which constitute the principal article of commerce in this country. They chiefly consist of fir and pine, for which great sums are received from foreigners, who export an immense number of masts, beams, planks, and boards. Besides, an incredible quantity is consumed at home in building houses, ships, bridges, piles, moles, and fences; over and above the vast demand for charcoal to the founderies, and fuel for domestic uses.—Nay, in some places, the trees are felled for no other purpose but to clear the ground and to be burned into ashes for manure. A good quantity of timber is yearly exported to Scotland and Spain: but this is inconsiderable when compared to the vast exports from Drammen, Frederickshall or Frederickstadt, Christiana, Skeen, Arendal, Christiansand, Christian's Bay, and Drontheim. The masts and large beams are floated down the rivers, and the rest is divided into boards at the saw mills. These works supply a vast number of families with a comfortable subsistence.—A tenth part of all sawed timber belongs to his Danish majesty, and makes a considerable branch of his revenue. The forests in Norway are so vast and thick, that the people seem to think there can never be a scarcity of wood, especially as the soil is peculiarly adapted for the production of timber: they therefore destroy it with a wasteful hand; insomuch that more wood rots in Norway than is burned in the whole kingdom of Denmark. The best timber grows in the provinces of Saltan, Helleland, Romsdale, Guldbrandsdale, Oesterdale, Soloe, Valders, Hallingdale, Sognifiord, Tellemark, and the lordship of Nedene.

The climate of Norway is very different in different parts of the kingdom. At Bergen the winter is so moderate, that the seas are always open and practicable both to mariners and fishermen, except in creeks and bays, that reach far up into the country towards Filefield, when the keen north-east wind blows from the land. On the east side of Norway from the frontiers of Sweden to Filefield, the cold generally sets in about the middle of October with great severity, and lasts till the middle of April; during which interval the waters are frozen to a very

Norway considerable thickness, and the face of the country is covered with snow. In the year 1719, 7500 Swedes, who intended to attack Drontheim, perished in the snow on the mountain of Ruden or Tydel, which separates Jemptcland in Sweden from the diocese of Drontheim. A company of 200 Norwegian sledge-men under Major Emahus, found them all frozen to death on the ridge of the mountain, where they had been surprised by a storm accompanied with snow, hail, and extreme cold. Some of these unhappy victims appeared sitting, some lying, and others kneeling in a posture of praying. They had cut in pieces their muskets, and burned the little wood they afforded.—The Generals Labarre and Zoega lost their lives; and of the whole corps, consisting originally of 10,000, no more than 2500 survived this dreadful catastrophe.

The cold is still more intense in that part of Norway called *Finmark*, situated in the frigid zone near the polar circle. But if the winter is generally cold, the summer is often excessively hot in Norway. The rays of the sun are reverberated from the sides of the mountains so as to render the weather close and sultry in the valleys; besides, the sun's absence below the horizon is so short, that the atmosphere and mountains have not time to cool. The heat is so great, that vegetation is remarkably quick. Barley is sown, grows, ripens, and is reaped, in the space of six weeks or two months. The longest day at Bergen consists of 19 hours; the sun rising at half an hour after two, and setting at half an hour after nine. The shortest day does not exceed six hours; for the sun rises at nine in the morning, and sets at three in the afternoon.—In the beginning of the year the daylight increases with remarkable celerity; and, at the approach of winter, decreases in the same proportion. In summer one may read and write at midnight by the light of the sky. Christian V. while he resided at Drontheim, used to sup at midnight without candles. In the district of Tromsen, at the extremity of Norway, the sun is continually in view at midsummer. It is seen to circulate day and night round the north pole, contracting its orbit, and then gradually enlarging it, until at length it leaves the horizon. In the depth of winter, therefore, it is for some weeks invisible; and all the light perceived at noon is a faint glimmering for about an hour and a half, proceeding from the reflexion of the sun's rays from the highest mountains. But the inhabitants of these provinces are supplied with other lights that enable them to follow their employments in the open air. The sky being generally serene, the moonshine is remarkably bright, and, being reflected from the mountains, illuminates the valleys. They are also assisted by the Aurora Borealis, which is very frequent in the northern parts of Europe.

The air of Norway is generally pure and salubrious. On the sea coasts, indeed, it is rendered moist by vapours and exhalations: but in the midland parts of the country, towards the mountains, the climate is so dry, that meat may be kept for many years without being worm eaten or damaged in the least. The inhabitants have no idea of sickness, except what is occasioned by excesses. It is said, that in the vale of Guldbrand the inhabitants live to such extreme old age, that they become weary of life, and cause themselves to be removed to a less salubrious climate, whereby they may have a chance of dying the sooner. In consumptions, however, the moist air on the sea side is found to be most agreeable to the lungs in respiration. Norway, being a mountainous country intersected by creeks, abounding with lakes, rivers, and snow, must be subject to frequent rains; and from sudden thaws the inhabitants are sometimes exposed to terrible disasters. Vast masses of snow falling from precipices overwhelm men, cattle, boats, houses, nay even whole villages.—About two centuries ago, a whole parish was covered and destroyed by an immense mass of snow; and several domestic utensils, as scissars, knives, and basons, have been at different times brought to light by a rivulet that runs under the snow, which has been gradually hardened and increased by repeated frosts and annual accessions. Norway.

The winds that chiefly prevail on the western coast are those that blow from the south; whereas, on the other side of Filefield, the winds that produce and continue the hard frosts are always northerly. In the summer, there is a kind of regular trade-wind on the coast of Bergen. In the forenoon the sea begins to be cooled with a westerly breeze, which continues till midnight. Then the land breeze begins from the east, and blows till about ten in the morning. The coast is likewise subject to sudden squalls and storms. Hurricanes sometimes rise at sea; and in these latitudes the phenomenon called a *water-spout* is not uncommon. One of these in the neighbourhood of Ferro is said to have sucked up with the water some lasts of herrings, which were afterwards dropped on Kolter, a mountain 1200 feet high.

The fresh water of Norway is not very light or pure; but on the contrary is generally turbid, and deposites a sediment of adventitious matter, being sometimes impregnated with ochre and particles of iron.—Nevertheless it is agreeable to the taste, and remarkably salubrious; as appears from the good health of the common people, who drink little or no other liquor.

The soil of Norway varies in different places according to the situation of rock or valley. The mountains here, as in every other country, are bare and barren; but the earth washed down from them by the rains enriches and fertilizes the valleys. In these the soil generally consists of black mould, sand, loam, chalk, and gravel, lying over one another in unequal strata, and sometimes in three or four successions: the mould that lies uppermost is very fine and mellow, and fit to nourish all sorts of vegetables. There is also clay found in different parts of this kingdom, of which the inhabitants begin to make earthen ware; but bricks and tiles are not used in building. The face of the country is in many places deformed by large swamps and marshes, very dangerous to the traveller. Near Leessoe in the diocese of Christiansand, a wooden causeway is extended near a mile over a morass; and if a horse or any other animal should make a false step, he will sink at once into the abyss, never to rise again.

In a cold country like Norway, roughened with rocks and mountains, interspersed with bogs, and covered with forests, we cannot expect to find agriculture in perfection. The ploughed lands, in respect to mountains, woods, meadows, and wastes, do not exceed the

Norway. the proportion of 1 to 80; so that the whole country does not produce corn to maintain above half the number of its inhabitants. The peasants are discouraged from the practice of husbandry by the frequency of accidents that seem peculiar to the climate. Even in the fruitful provinces of Guldbrandsdale, Oesterdale, and Soloer, as well as in other places, when the corn appears in the most flourishing condition the whole hope of the harvest is sometimes destroyed in one night by a sudden frost that nips the blade and extinguishes the vegetation. The kingdom is moreover visited by some unfavourable years, in which the sun seems to have lost his genial power; the vegetables are stunted; the trees bud and bloom, yet bear no fruit; and the grain, though it rises, will yet produce nothing but empty ears and straw. This calamity, however, rarely occurs; and in general the cultivated parts of Norway yield plentiful crops of excellent rye, barley, and oats. The most fruitful provinces are Nordland, Inderbarre, and Numedale, in the diocese of Drontheim; Sognifiord and Vaas, in that of Bergen; Jedderen, Ryefylsk, Raabygdelag, and the lordship of Nedenes, in the diocese of Christiansand; Hedemark in the diocese of Aggerhus; Hadeland, Toten, Romerige, Ringerige, and Guldbrandsdale: these territories not only produce grain enough for their own consumption, but likewise support their neighbours, and even supply part of Sweden.—Pease are likewise propagated in this country, together with wheat, buck-wheat, hops, hemp, and flax, but not to any considerable advantage. The meadows are well stored with pasturage for sheep and cattle, and the fields are productive of those vegetables which are common in other northern countries. Within these 50 years the people of Norway have bestowed some attention on the culture of gardens, which in former times was so neglected, that the cities and towns were supplied with leeks, cabbage, and roots, from England and Holland. At present, however, the Norwegians raise their own culinary and garden roots and vegetables, which thrive there as well as in any other country. The scurvy being a disease that prevails along the sea coast, Nature has scattered upon it a variety of herbs efficacious in the cure of that distemper; such as angelica, rose-wort, gentian, cresses, trefoil, sorrel, scurvy-grass, and a plant called *erich's grass*, that grows in great plenty on the islands of Northland: from whence the people of the continent fetch away boat loads of it, to be preserved in barrels as a succedaneum for cabbage. There are also a few noxious vegetables little known in any country but Norway. In Guldbrandsdale is a species of grass called *selsnape*; the root of which is so poisonous, that any beast which eats of it dies immediately, the belly bursting; nay, the carnivorous fowls that prey upon the carcass of the beast meet with the same fate: children have been more than once poisoned by this root, which nevertheless is sometimes used externally as an amulet for arthritic disorders. Another vegetable pernicious to the cattle is the *Gramen ossifragum Norwegiense*, which is said to mollify the bones of the cattle which feed upon it. Among the noxious plants of Norway we may also reckon the igle-grass, fatal to sheep and goats; the tour-grass, which affects horses and cows with a sort of lethargy; and the plant torboe, or histe-spring, which produces nearly the Norway. same effect on horses, but is not at all prejudical to cows, sheep, or any ruminating animals. The herb turte, not unlike angelica, operates nearly in the same manner; yet the bears are said to feed upon it with peculiar relish; and when their hair begins to fall off by feeding upon this plant, they cure themselves by eating the flesh of animals.

The common fruit trees thrive tolerably well in Norway, the inhabitants of which have plenty of cherries, apples, and pears. Some kinds of plums attain maturity; which is seldom the case with grapes, apricots, and peaches. But even the apples and pears that ripen have the summer fruit; that which grows till the winter seldom coming to perfection. Great variety of agreeable berries are produced in different parts of this kingdom; such as the hagebar, a kind of sloes; an infusion of which in wine makes a pleasant cooling liquor; juniper berries, corinths red and white, soelbar or sun berries, raspberries, gooseberries, blackberries, strawberries, &c. with many other species that seem to be natives of Norway and Sweden. Among those are the tranebar, the produce of the myrtillus repens, red and austere, found in the spring in perfection under the snow, and much relished by the reindeer; crakebeer, resembling bilberries, deemed a powerful antiscorbutic; agerbeer, larger and blacker than bilberries, of a pleasant acid, ripened by cold, and used as cherries for an infusion in wine; and finally tyltebeer, a red pleasant berry growing on a short stem, with leaves like those of box, they are plucked off by handfuls, and sent to Denmark to be preserved for the table, where they are eaten by way of dessert.

Of the trees that grow wild in Norway, the principal are the fir and the pine. The first yield an annual revenue of 1,000,000 of rixdollars, if we include the advantages resulting from the saw mills and the masts; one of which last has been known to sell for 200 rixdollars. The red fir tree, which grows on the mountains, is so rich in turpentine as to be almost incorruptible. Some of the houses belonging to the Norway peasants, built of this timber, are supposed to be above 400 years standing. In Guldbrandsdale the house is still to be seen standing in which King Olaf lodged five nights, above 700 years ago, when he travelled round the kingdom to convert the people to the Christian faith. Even 100 years after the trunk of the fir tree has been cut down, the peasants burn the roots for tar, which is a very profitable commodity. In the fens, the resin of the fir tree is by nature transformed into a substance which may be called *Norway frankincense*. The buds or pine apples of this tree, boiled in stale beer, make an excellent medicine for the scurvy; less unpleasant to the taste, though as efficacious, as tar-water. The pine tree is more tall and beautiful than the fir, though inferior to it in strength and quality: for which reason the planks of it are sold at an inferior price, and the peasants waste it without remorse. Norway likewise produces some forests of oak, which is found to be excellent for ship-building. Here also grow plenty of elm trees; the bark of which, being powdered, is boiled up with other food to fatten hogs, and even mixed by the poor among their meal: also the ash, from which the peasants distil a balsam used in certain

certain disorders, and which is used both externally and internally. Many other trees flourish in this country, an enumeration of which would prove too tedious. Hazels grow here in such abundance, that 100 tons of the nuts are annually exported from Bergen alone.

A great diversity of stones is found in Norway, some of which are of a surprising figure. Several mountains consist chiefly of a brown pebble, which decays with age; nay, it sometimes dissolves, and drops into the sea, and the cement being thus loosened, a terrible disruption ensues. In some places the gray and black pebbles are intermixed with iron, copper, lead, silver, and gold. The ground in certain districts is covered with the fragments of rocks that have been precipitated from the summits of mountains, and broken by their fall into innumerable shivers. Between 20 and 30 years ago, in the neighbourhood of Bergen, a man was suddenly overwhelmed with such a mass, which formed a kind of vault around him. In this dreadful tomb he remained alive for several weeks. By his loud cries the place of his confinement was discovered: but it was found impossible to remove the huge stones by which he was enclosed. All that his friends could do for him was, to lower down meat and drink through some crevices; but at length the stones fell in, and crushed him to death.

In Norway are inexhaustible quarries of excellent marble, black, white, blue, gray, and variegated; together with some detached pieces of alabaster, several kinds of spar, chalk-stone, cement-stone, sand-stone, mill-stone, baking-stone, slate, talc, magnets; and swine-stone, a production natural to Norway and Sweden, of a brown colour, fetid smell, in texture resembling crystal, and deriving its name from a supposed efficacy in curing a distemper incident to swine. Here also is found the amianthus or stone-flax, of which incombustible cloth may be made. Norway, however, affords no flints, but plenty of pyrites or quartz, beautiful crystals, granites, amethysts, agate, thunder-stones, and eagle-stones. Gold has formerly been found in a small quantity in the diocese of Christiansand, and coined into ducats. There is at present a very considerable silver mine wrought at Kongsberg on the account and at the risk of his Danish majesty: the ore is surprisingly rich, but interrupted in such a manner, that the vein is often lost. Many masses of pure silver have been found; and, among the rest, one piece weighing 560 pounds, preserved in the royal museum at Copenhagen. Such is the richness of these mines, that the annual produce amounts in value to a ton and a half in gold. About 5000 people are daily employed, and earn their subsistence, in those stupendous works (A). Other silver mines are prosecuted at Jarlsberg, but not to the same advantage; and here the ore is mixed with lead and copper. In many parts of this country copper mines have been discovered; but the principal, and perhaps the richest in all Europe, is at Roraas, about 100 English miles from Drontheim. The work yields annually about 1100 ship pounds of pure copper: the founderies belonging to it consume yearly about 14,000 lasts of coal, and 500 fathoms of wood. The next in importance is the copper work at Lykken, about 20 miles from Drontheim. A third mine is carried on at Indset or Quickne, at the distance of 30 miles from the same place; and here they precipitate the copper from its menstruum, by means of iron. There is a fourth copper work at Silboe, about 30 miles distant from Drontheim, though the least considerable of the four. Other copper mines of less note are worked in different parts of the kingdom. Iron is still in greater plenty, and was the first metal wrought in this country. Many hundred thousand quintals are annually exported, chiefly in bars, and part of it in stoves, pots, kettles, and cannon: the national profit arising from this metal is estimated at 300,000 rixdollars. There is a species called *moor-iron*, found in large lumps among the morasses: of this the peasants make their own domestic tools and utensils, such as knives, scythes, and axes. The lead found mixed in the silver ore is an article of small importance in Norway; yet some mines of this metal have been lately opened in the district of Soloer by the proprietors of the copper work at Oudal. A vitriol work has been begun near Kongsberg: the mines yield great plenty of sulphur; which, however, the Norwegians will not take the trouble to melt and depurate, because immense quantities are found at a cheaper rate in the island of Iceland. Alum is found between the slate flakes near Christiana in such plenty, that works have been set up for refining this mineral, though they have not yet brought it to any degree of transparency. His Danish majesty has established salt works in the peninsula of Valoe, about six English miles from Tonsberg, where this mineral is extracted in large quantities from the sea water.

Besides the animals common to other countries, Norway is said to contain many of the uncommon and dubious kind; such as the kraken, mermaid, sea serpent, &c. See these articles.

Many Danish, English, Scotch, Dutch, and German families have now settled in Norway; and indeed form no inconsiderble part of the trading people: but the original inhabitants are the descendants of those ferocious Normanni, who harassed almost all the coasts of Europe with piratical armaments in the 8th, 9th, and 10th centuries.

"Our first certain knowledge of the inhabitants of this country (says Pennant †) was from the desolation they brought on the southern nations by their piratical invasions. Their country had before that period the name of *Nortmannaland*, and the inhabitants

† *Arct. Zool.*

(A) Mr Coxe tells us, that he visited those mines. They formerly, he says, produced annually 70,000l. but at present yield little more than 50,000l. The expences generally exceed the profits; and government gains only by the number of miners employed. The mines of cobalt, and the preparation of Prussian blue, are much more productive. The latter goes through 270 hands, and the number of men employed are 356. It is supposed, that, at this period (1793), it may produce to government a profit of 16,000l. a-year.

Norway. tants *Normans*; a title which included other adjacent people. Great Britain and Ireland were ravaged by them in 845; and they continued their invasion till they effected the conquest of England, under their leader Canute the Great. They went up the Seine as far as Paris, burnt the town, and forced its weak monarch to purchase their absence at the price of fourteen thousand marks. They plundered Spain, and at length carried their excursions through the Mediterranean to Italy, and even into Sicily. They used narrow vessels, like their ancestors the Sitones; and, besides oars, added the improvement of two sails; and victualled them with salted provisions, biscuit, cheese, and beer. Their ships were at first small; but in after times they were large enough to hold 100 or 120 men. But the multitude of vessels was amazing. The fleet of Harold Blaatand consisted of 700. A hundred thousand of these savages have at once sailed from Scandinavia, so justly styled *Officina gentium, aut certè velut vagina nationum.* Probably necessity, more than ambition, caused them to discharge their country of its exuberant numbers. Multitudes were destroyed; but multitudes remained, and peopled more favourable climates.

"Their king, Olaus, was a convert to Christianity in 994; Bernard an Englishman had the honour of baptizing him, when Olaus happened to touch at one of the Scilly islands. He plundered with great spirit during several years; and in 1006 received the crown of martyrdom from his pagan subjects. But religious zeal first gave the rest of Europe a knowledge of their country and the sweets of its commerce. The Hanse towns poured in their missionaries, and reaped a temporal harvest. By the year 1204, the merchants obtained from the wise prince Suer every encouragement to commerce; and by that means introduced wealth and civilization into his barren kingdom. England by every method cherished the advantages resulting from an intercourse with Norway, and Bergen was the emporium. Henry III. in 1217, entered into a league with its monarch Haquin; by which both princes stipulated for free access for their subjects into their respective kingdoms, free trade, and security to their persons. In 1269, Henry entered into another treaty with Magnus; in which it was agreed, that no goods should be exported from either kingdom except they had been paid for; and there is, besides a humane provision on both sides, for the security of the persons and effects of the subjects who should suffer shipwreck on their several coasts."

The inhabitants now speak the same language that is used in Denmark, though their original tongue is the dialect now spoken in Iceland. They profess the Lutheran religion, under an archbishop established at Drontheim, with four suffragans; namely, of Bergen, Staffanger, Hammer, and Christiana. By the union of Calmar, the two kingdoms of Norway and Denmark were united under one monarch; and then the people of both nations enjoyed considerable privileges: but the Danish government soon became absolute; and Norway was ruled despotically by a viceroy, who resided in the capital, and presided in the supreme court, to which appeals were made from the subordinate courts of judicature. A great change has, however, taken place since the present amiable and accomplished prince of Denmark had part of the government; and more may be expected from his virtue and assiduity when the power shall come wholly into his own hands.

The Norwegians are generally well formed, tall, sturdy, and robust, brave, hardy, honest, hospitable, and ingenious; yet savage, rash, quarrelsome, and litigious. The same character will nearly suit the inhabitants of every mountainous country in the northern climates. Their women are well shaped, tall, comely, remarkably fair, and obliging. The nobility of Norway have been chiefly removed by the kings of Denmark, in order [illegible] prevent faction and opposition to the court; or are [illegible] degenerated into the rank of peasants: some [illegible], however, have been lately raised to that dignity. Every freeholder in Norway enjoys the right of primogeniture and power of redemption; and it is very usual to see a peasant inhabiting the same house which has been possessed 400 years by his ancestors. The *odels-gads*, or freehold, cannot be alienated by sale or otherwise from the right heir, called *odels-mand*: if he is not able to redeem the estate, he declares his incapacity every 10th year at the sessions; and if he, or his heirs to the third generation, should acquire wealth enough for that purpose, the possessor *pro tempore* must resign his possession.

The mountaineers acquire surprising strength and dexterity by hard living, cold, laborious exercise, climbing rocks, skating on the snow, and handling arms, which they carry from their youth to defend themselves against the wild beasts of the forest. Those who dwell in the maritime parts of Norway exercise the employments of fishing and navigation, and become very expert mariners.

The peasants of Norway never employ any handicraftsmen for necessaries to themselves and families: they are their own hatters, shoemakers, taylors, tanners, weavers, carpenters, smiths, and joiners: they are even expert at ship-building; and some of them make excellent violins. But their general turn is for carving in wood, which they execute in a surprising manner with a common knife of their own forging. They are taught in their youth to wrestle, ride, swim, skate, climb, shoot, and forge iron. Their amusements consist in making verses, blowing the horn, or playing upon a kind of guitar, and the violin: this last kind of music they perform even at funerals. The Norwegians have evinced their valour and fidelity in a thousand different instances. The country was always distracted by intestine quarrels, which raged from generation to generation. Even the farmers stand upon their punctilio, and challenge one another to single combat with their knives. On such occasions they hook themselves together by their belts, and fight until one of them is killed or mortally wounded. At weddings and public feasts they drink to intoxication, quarrel, fight, and murder generally ensues. The very common people are likewise passionate, ambitious of glory and independence, and vain of their pedigree. The nobility and merchants of Norway fare sumptuously; but the peasant lives with the utmost temperance and frugality, except at festivals: his common bread is made of oatmeal, rolled into broad thin cakes, like those used

Norway. uſed in Scotland. In time of ſcarcity, they boil, dry, and grind the bark of the fir tree into a kind of flour which they mix with oat meal; the bark of the elm tree is uſed in the ſame manner. In thoſe parts where a fiſhery is carried on, they knead the roes of cod with their oat meal. Of theſe laſt, mixed with barley meal, they make haſty pudding and ſoup, enriched with a pickled herring or ſalted mackarel. Freſh fiſh they have in plenty on the ſea coaſt. They hunt and eat grouſe, partridge, hare, red deer, and rein-deer. They kill cows, ſheep, and goats, for their winter ſtock: theſe they pickle, or ſmoke, or dry for uſe. They make cheeſe of their milk, and a liquor called *ſyre* of their ſour whey: [illegible] they commonly drink mixed with water; but th[illegible]ide a ſtore of ſtrong ale for Chriſtmas, wedd[illegible]chriſtenings, and other entertainments. From their temperance and exercife, joined to the purity and elaſticity of their air, they enjoy good health, and often attain to a ſurpriſing degree of longevity. Nothing is more common than to ſee a hearty Norwegian turned of 100. In the year 1733, four couples danced before his Daniſh majeſty at Frederickſhall: their ages, when joined, exceeded 800 years. Nevertheleſs, the Norwegians are ſubject to various diſeaſes; ſuch as the ſcab, the leproſy, the ſcurvy, the catarrh, the rheumatiſm, gout, and epilepſy. The dreſs of the Norway peaſants conſiſts of a wide looſe jacket made of coarſe cloth, with waiſtcoat and breeches of the ſame. Their heads are covered with flapped hats, or caps ornamented with ribbons. They wear ſhoes without outer ſoles, and in the winter leathern buſkins. They have likewiſe ſnow ſhoes and long ſkates, with which they travel at a great pace, either on the land or ice. There is a corps of ſoldiers thus accoutred, who can outmarch the ſwifteſt horſes. The Norwegian peaſant never wears a neckcloth, except on extraordinary occaſions: he opens his neck and breaſt to the weather, and lets the ſnow beat into his boſom. His body is girt round with a broad leathern belt, adorned with braſs plates, from which depends a braſs chain that ſuſtains a large knife, gimlet, and other tackle. The women are dreſſed in cloſe laced jackets, having leathern girdles decorated with ornaments of ſilver. They likewiſe wear ſilver chains round their necks, to the ends of which are fixed gilt medals. Their caps and handkerchiefs are almoſt covered with ſmall plates of ſilver, braſs, and tin, large rings, and buttons. A maiden bride appears with her hair plaited, and, together with her clothes, hung full of ſuch jingling trinkets.

The churches, public edifices, and many private houſes in Norway, are built of ſtone: but the people in general live in wooden houſes, made of the trunks of fir and pine tree laid upon each other, and joined by mortiſes at the corners. Theſe are counted more dry, warm, and healthy, than ſtone or brick buildings. In the whole dioceſe of Bergen, one hardly ſees a farm houſe with a chimney or window: they are generally lighted by a ſquare hole in the top of the houſe, which lets in the light, and lets out the ſmoke. In ſummer this hole is left quite open: in the winter, it is covered with what they call a *ſiau*; that is the membrane of ſome animal, ſtretched upon a wooden frame that fits the hole, and tranſmits the rays of light. It is fixed or removed with a long pole occaſionally. Every perſon that enters the houſe, upon buſineſs or [illegible], takes hold of this pole, according to an[illegible]cuſtom. The ceiling is about eight feet high in the middle; and, being arched like a cupola, the ſmoke of the fire underneath rolls about, until it finds a vent at the hole, which is called *liur*. Under this opening ſtands a thick table with benches, and a high ſeat at the upper end for the maſter of the family: he has likewiſe a ſmall cupboard for his own uſe, in which he locks up his moſt valuable effects. The boards of the roof are coated with the bark of the birch trees, which is counted incorruptible: this again is covered with turf, which yields a good crop of graſs for goats and ſheep, and is often mowed as hay by the farmer. Norway ‖ Norwich

The Norwegians carry on a conſiderable trade with foreign nations. The duty on the produce of their own country exported, amounts annually to 100,000 rixdollars. Theſe commodities are, copper wrought and unwrought; iron caſt into cannon, ſtoves, and pots, or forged into bars; lead, in ſmall quantity; maſts, timber, deal boards, planks, marble, millſtones, herring, cod, ling, ſalmon, lobſters, flounders, cow hides, goat ſkins, ſeal ſkins, the furs of bears, wolves, foxes, beavers, ermines, martens, &c. down, feathers, butter, tallow, train oil, tar, juniper and other ſorts of berries, and nuts; ſalt, alum, glaſs, vitriol, and pot aſhes. All other commodities and articles of luxury the Norwegians import from different nations. The nature of the ground does not admit of much improvement in agriculture: nevertheleſs, the farmers are not deficient in induſtry and ſkill to drain marſhes, and render the ground arable and fit for paſture. Many are employed in grazing and breeding cattle: but a much greater number is engaged in felling wood, floating timber, burning charcoal, and extracting tar from the roots of the trees which have been cut down in the ſilver, copper, and iron mines; in the navigation and fiſhery. A conſiderable number of people earn a comfortable livelihood by hunting, ſhooting, and bird catching. Every individual is at liberty to purſue the game, eſpecially in the mountains and commons: therefore every peaſant is expert in the uſe of fire arms; and there are excellent markſmen among the mountains, who make uſe of the bow to kill thoſe animals, whoſe ſkins, being valuable, would be damaged by the ſhot of fire arms.

Norway can produce above 14,000 excellent ſeamen. The army of this country amounts to 30,000 effective men; and the annual revenue exceeds 800,000 rixdollars.

*Norway Rat*, in zoology. See Mus.

NORWICH, the capital of the county of Norfolk in England, ſituated in E. Long. 1. 26. N. Lat. 52. 40. It is ſuppoſed to have had its name, which ſignifies "a caſtle to the north," from its ſituation in reſpect of Caſtor, the ancient Venta Icenorum, three or four miles to the ſouth of it, out of whoſe ruins it ſeems to have riſen. In its infancy, in the reign of Etheldred, it was plundered and burnt by Sueno the Dane, when he invaded England with a great army. Afterwards it recovered; and in the reign of Edward

Numidia.

warded by the Romans for the important services he had done them. As for Syphax, after the loss of his dominions, he was kept in confinement for some time at Alba; from whence being removed in order to grace Scipio's triumph, he died at Tibur in his way to Rome. Zonaras adds, that his corpse was decently interred; that all the Numidian prisoners were released; and that Vermina, by the assistance of the Romans, took peaceable possession of his father's throne. [illegible] part of the Massæsylian kingdom had been before annexed to Masinissa's dominions, in order to [illegible] that prince for his singular fidelity and close [illegible] to the Romans.

This seems to be countenanced by the [illegible] of Livy, who gives us sufficiently to understand [illegible] Syphax's family, for a considerable time after the conclusion of the second Punic war, reigned in [illegible] of Numidia. For he intimates, that Archobarzanes, Syphax's grandson, and probably Vermina's son, hovered with a powerful army of Numidians upon the Carthaginian frontiers a few years before the beginning of the third Punic war. This he seems to have done, either in order to cover them, or to enable the Carthaginians to make an irruption into Masinissa's territories. Cato, however, pretended that these forces, in conjunction with those of Carthage, had a design to invade the Roman dominions, which he urged as a reason to induce the conscript fathers to destroy the African republic.

Nothing is further requisite, in order to complete the history of this famous prince, than to exhibit to our readers view some point of his conduct towards the decline, and at the close, of life; the wise dispositions made after his death by Æmilianus, in order to the regulation of his domestic affairs; and some particulars relating to his character, genius, and habit of body, drawn from the most celebrated Greek and Roman authors.

By drawing a line of circumvallation around the Carthaginian army under Asdrubal, posted upon an eminence, Masinissa cut off all manner of supplies from them; which introduced both the plague and famine into their camp. As the body of Numidian troops employed in this blockade was not near so numerous as the Carthaginian forces, it is evident, that the line here mentioned must have been extremely strong, and consequently the effect of great labour and art. The Carthaginians, finding themselves reduced to the last extremity, concluded a peace upon the following terms, which Masinissa dictated to them: 1. That they should deliver up all deserters. 2. That they should recal their exiles, who had taken refuge in his dominions. 3. That they should pay him 5000 talents of silver within the space of 50 years. 4. That their soldiers should pass under the jugum, each of them carrying off only a single garment. As Masinissa himself, though between 80 and 90 years of age, conducted the whole enterprise, he must have been extremely well versed in fortification, and other branches of the military art. His understanding likewise [illegible] must have retained to the last. This happened a short time before the beginning of the third Punic war. See CARTHAGE.

Soon after, the consuls landed an army in Africa, in order to lay siege to Carthage, without imparting to Masinissa their design. This not a little chagrined him, as it was contrary to the former practice of the Romans; who in the preceding war had communicated their intentions to him, and consulted him on all occasions. When, therefore, the consuls applied to him for a body of his troops to act in concert with their forces, he made answer, "That they should have a reinforcement from him when they stood in need of it." It could not but be provoking to him to consider, that after he had extremely weakened the Carthaginians, and even brought them to the brink of ruin, his pretended imperious friends should come to reap the fruits of his victory, without giving him the least intelligence of it.

5 Masinissa displeased with the Romans;

However, his mind soon returned to its natural bias, which was in favour of the Romans. Finding his end approaching, he sent to Æmilianus, then a tribune in the Roman army, to desire a visit from him. What he proposed by this visit, was to invest him with full powers to dispose of his kingdom and estate as he should think proper, for the benefit of his children. The high idea he had entertained of that young hero's abilities and integrity, together with his gratitude and affection for the family into which he was adopted, induced him to take this step. But, believing that death would not permit him to have a personal conference with Æmilianus upon this subject, he informed his wife and children in his last moments, that he had empowered him to dispose in an absolute manner of all his possessions, and divide his kingdom amongst his sons. To which he subjoined, "I require, that whatever Æmilianus may decree, shall be executed as punctually as if I myself had appointed it by my will." Having uttered these words, he expired, at about 90 years of age.

6 But leaves every thing to the disposal of Æmilianus

This prince, during his youth, had met with strange reverses of fortune. However, says Appian, being supported by the Divine protection, he enjoyed an uninterrupted course of prosperity for a long series of years. His kingdom extended from Mauritania to the western confines of Cyrenaica; from whence it appears, that he was one of the most powerful princes of Africa. Many of the inhabitants of this vast tract he civilized in a wonderful manner, teaching them to cultivate their soil, and to reap those natural advantages which the fertility of some parts of their country offered them. He was of a more robust habit of body than any of his cotemporaries, being blessed with the greatest health and vigour; which was doubtless owing to his extreme temperance, and the toils he incessantly sustained. We are informed by Polybius, that sometimes he stood upon the same spot of ground from morning till evening, without the least motion, and at others continued as long in a sitting posture. He would remain on horseback for several days and nights together, without being sensible of the least fatigue. Nothing can better evince the strength of his constitution, than his youngest son, named *Stembal*, *Sthemba*, or *Stemlanus*, who was but four years old at his decease. Though 90 years of age, he performed all the exercises used by young men, and always rode without a saddle. Pliny tells us, that he reigned above 60 years. He was an able commander, and much facilitated the reduction of Carthage. Plutarch from Polybius observes, that the day after a great victory won

Numidia. over the Carthaginians, Masinissa was seen sitting at [illegible] door of his tent, eating a piece of brown bread. Suidas relates, that to the last he could mount his horse without any assistance. According to Appian he left a numerous well disciplined army, and an immense quantity of wealth, behind him.

Masinissa, before his death, gave his ring to his eldest son Micipsa; but left the distribution of all his other effects and possessions amongst his children entirely to Æmilianus. Of 54 sons that survived him, only three were legitimate, to wit, Micipsa, Gulussa, and Mastanabal. Æmilianus, arriving [illegible] after he had expired, divided [illegible]s kingdom, or rather the government of it, among [illegible] though to the others he gave considerab[illegible] possessions. To Micipsa, who was a prince of a pacific [illegible], and the eldest son, he assigned Cirta, [illegible] metropolis, for the place of his residence, in exclusion [illegible] others. Gulussa, the next to him, being a prince of a military genius, had the command of the army, and the transacting of all affairs relating to peace [illegible] committed to his care. And Manastabal, the youngest, had the administration of justice, an employment suitable to his education, allotted him. They enjoyed in common the immense treasures Masinissa had amassed, and were all of them dignified by [illegible]milianus with the royal title. After he had made these wise dis[illegible], that young nobleman departed from Cirta, taking with him a body of Numidian troops, under the conduct of Gulussa, to reinforce the Roman army that was then acting against the Carthaginians.

Mastanabal and Gulussa died soon after their father, as appears from the express testimony of Sallust. We find nothing more remarkable of these princes, besides what has been already related, than that the latter continued to assist the Romans in the third Punic war, and that the former was pretty well versed in the Greek language. Micipsa therefore became sole possessor of the kingdom of Numidia. In his reign, and under the consulate of M. Plautius Hypsæus and M. Fulvius Flaccus, according to Orosius, a great part of Africa was covered with locusts, which destroyed all the produce of the earth, and even devoured dry wood. But at last they were all carried by the wind into the African sea, out of which being thrown in vast heaps upon the shore, a plague ensued, which swept away an infinite number of animals of all kinds. In Numidia only 800,000 men perished, and in Africa Propria 200,000; amongst the rest, 30,000 Roman soldiers quartered in and about Utica for the defence of the latter province. At Utica, in particular, the mortality raged to such a degree, that 1500 dead bod[illegible] were carried out of one gate in a day. Micipsa had two sons, Adherbal and Hiempsal, whom he educated in his palace, together with his nephew Jugurtha. That young prince was the son of Mastanabal; but his mother having been only a concubine, Masinissa had taken no great notice of him. However, Micipsa considering him as a prince of the blood, took as much care of him as he did of his own children.

7 History of Jugurtha. Jugurtha possessed several eminent qualities, which gained him universal esteem. He was very handsome, endued with great strength of body, and adorned with the finest intellectual endowments. He did not devote himself, as young men commonly do, to a life of luxury and pleasure. He used to exercise himself, with persons of his age, in running, riding, hurling [illegible] javelin, and other manly exercises, suited to the martial genius of the Numidians, and though he surpassed all his fellow sportsmen, there was not one of them but loved him. The chase was his only delight; but it [illegible] that of lions and other savage beasts. Sallust, to [illegible] his character, tells us, that he excelled in all [illegible] spoke very little of himself.

[illegible]us an assemblage of fine talents and per[illegible] first charmed Micipsa, who thought them an ornament to his kingdom. However, he soon began to reflect, that he was considerably advanced in [illegible] children in their infancy; that mankind [illegible]rsted after power, and that nothing was [illegible]ing men run greater lengths than a vi[illegible] unlimited ambition. These reflections soon [illegible] jealousy, and determined him to expose Jugurtha to a variety of dangers, some of which, he entertained hopes, might prove fatal to him. In order to this, he gave him the command of a body of forces which he sent to assist the Romans, who were at that time besieging Numantia in Spain. But Jugurtha, by his admirable conduct, not only escaped all those dangers, but likewise won the esteem of the whole army, and the friendship of Scipio, who sent a high character of him to his uncle Micipsa. However, that general gave him some prudent advice in relation to his future conduct; observing, no doubt, in him certain sparks of ambition, which, if lighted into a flame, he apprehended might one day be productive of the most fatal consequences.

8 Is dreaded by King Micipsa, Before this last expedition, Micipsa had endeavoured to find out some method of taking him off privately; but his popularity amongst the Numidians obliged that prince to lay aside all thoughts of this nature. After his return from Spain the whole nation almost adored him. The heroic bravery he had shown there, his undaunted courage, joined to the utmost calmness of mind, which enabled him to preserve a just medium between a timorous foresight and an impetuous rashness, a circumstance rarely to be met with in persons of his age, and above all the advantageous testimonials of his conduct given by Scipio, attracted an universal esteem. Nay, Micipsa himself, charmed with the high opinion the Roman general had entertained of his merit, changed his behaviour towards him; resolving, if possible, to win his affection by kindness. He therefore adopted him, and declared him joint heir with his two sons to the crown. Finding, some few years afterwards, that his end approached, he sent for all three to his bed side, where, in the presence of the whole court, he desired Jugurtha to recollect with what extreme tenderness he had treated him, and consequently to consider how well he had deserved at his hands.

9 who nevertheless intrusts him with the care of his children, He then entreated him to protect his children on all occasions, who, being before related to him by the t[illegible] of blood, were now by their father's bounty be[illegible] his brethren. In order to fix him the more firmly [illegible] their interest, he likewise complimented him upon his bravery, address, and consummate prudence. He further insinuated, that neither arms nor treasures constitute the strength of a kingdom; but friends, who are neither won by arms nor gold, but by real services and an inviolable fidelity. "Now, where (continued he)

Numidia. he) can we find better friends than in brothers? And how can that man who becomes an enemy to his relations, repose any confidence in, or depend upon strangers?" Then addressing himself to Adherbal and Hiempsal, "And you (said he) I enjoin always to pay the highest reverence to Jugurtha. Endeavour to imitate, and if possible surpass, his exalted merit, that the world may not hereafter observe Micipsa's adopted son to have reflected greater glory upon his memory than his own children." Soon after, Micipsa, who, according to Diodorus, was a prince of an amiable character, expired. Though Jugurtha did not believe the king to speak his real sentiments with regard to him, yet he seemed extremely pleased with so gracious a speech, and made him an answer suitable to th[illegible] However, that prince at the same time was d[illegible] within himself to put in execution the scheme [illegible] formed at the siege of Numantia, which was suggest[ed] to him by some factious and abandoned Roman officers, with whom he there contracted an acquaintance. The purport of this scheme was, that he should extort the crown by force from his two cousins, as soon as their father's eyes were closed; which they insinuated might easily be effected by his own valour, and the venality of the Romans. Accordingly, a short time after the old king's death, he found means to assassinate Hiempsal in the city of Thirmida where his treasures were deposited, and drive Adherbal out of his dominions. That unhappy prince found himself obliged to fly to Rome, where he endeavoured to engage the conscript fathers to espouse his quarrel; but, notwithstanding the justice of his cause, they had not virtue enough effectually to support him. Jugurtha's ambassadors, by distributing vast sums of money amongst the senators, brought them so far over, that a majority palliated his inhuman proceedings. This encouraged those ministers to declare, that Hiempsal had been killed by the Numidians on account of his excessive cruelty; that Adherbal was the aggressor in the late troubles; and that he was only chagrined because he could not make that havock among his countrymen he would willingly have done. They therefore entreated the senate to form a judgment of Jugurtha's behaviour in Africa from his conduct at Numantia, rather than from the suggestions of his enemies. Upon which, by far the greatest part of the senate discovered themselves prejudiced in his favour. A few, however, that were not lost to honour, nor abandoned to corruption, insisted upon bringing him to condign punishment. But as they could not prevail, he had the best part of Numidia allotted him, and Adherbal was forced to rest satisfied with the other.

10 one of whom he murders, and drives out the other.

11 [illegible]enality of [illegible]e Ro[illegible]

Jugurtha finding now by experience that every thing was venal at Rome, as his friends at Numantia had before informed him, thought he might pursue his towering projects without any obstruction from that quarter. He therefore, immediately after the last division of Micipsa's dominions, threw off the mask, attacked his cousin by open force. As Adherbal [illegible] a prince of a pacific disposition, and almost in a[illegible] spects the reverse of Jugurtha, he was by no means a match for him. The latter therefore pillaged the former's territories, stormed several of his fortresses, and overran a good part of his kingdom without opposition. Adherbal, depending on the friendship of the Romans, which his father in his last moments assured him would be a stronger support to him than all the troops and treasures in the universe, despatched deputies to Rome to complain of these hostilities. But whilst he lost his time in sending thither fruitless deputations, Jugurtha overthrew him in a pitched battle, and soon after shut him up in Cirta. During the siege of this city, a Roman commission arrived there, in order to persuade both parties to an accommodation; but finding Jugurtha untractable, the commissioners returned home without so much as conferring with Adherbal. A second deputation, composed of senators of the highest distinction, with Æmilius Scaurus, president of the [illegible] their head, landed some time after at Utica, and summoned Jugurtha to appear before them. That prince, at first seemed to be under dreadful apprehensions, especially as Scaurus reproached him with his enormous crimes, and threatened him with the resentment of the Romans if he did not immediately [illegible] the siege of Cirta. However, the Nu[illegible] by his address, and the irresistible power of [illegible] was afterwards [illegible] at Rome, so molli[illegible], that he left Adherbal at his mercy. In [illegible] Jugurtha had at last Cirta surrendered to him, upon condition only that he should spare the life of Adherbal. But the merciless tyrant, in violation of the laws of nature and humanity as well as the capitulation, when he had got possession of the town, ordered him to be put to a most cruel death. The merchants likewise, and all the Numidians in the place capable of bearing arms, he caused without distinction to be put to the sword.

Every person at Rome inspired with any sentiments of humanity, was struck with horror at the news of this tragical event. However, all the venal senators still concurred with Jugurtha's ministers in palliating his enormous crimes. Notwithstanding which, the people, excited thereto by Caius Memmius their tribune, who bitterly inveighed against the venality of the senate, resolved not to let so flagrant an instance of villany go unpunished. This disposition in them induced the conscript fathers likewise to declare their intention to chastise Jugurtha. In order to this, an army was levied to invade Numidia, and the command of it given to the consul Calpurnius Bestia, a person of good abilities, but rendered unfit for the expedition he was to go upon by his insatiable avarice. Jugurtha being informed of the great preparations making at Rome to attack his dominions, sent his son thither to avert the impending storm. The young prince was plentifully supplied with money, which he had orders to distribute liberally amongst the leading men. But Bestia, proposing to himself great advantages from an invasion of Numidia, defeated all his intrigues, and got a decree passed, ordering him and his attendants to depart Italy in ten days, unless they were come to deliver up the king himself, and all his territories, to the republic by way of dedition. Which decree being [illegible]tified to them, they returned without so much as [illegible]aving entered the gates of Rome; and the consul soon after landed with a powerful army in Africa. For some time he carried on the war there very briskly, reduced several strong holds, and took many Numidians prisoners. But upon the arrival of Scaurus, a peace was granted Jugurtha upon advantageous terms.

That

Numidia. That prince coming from Vacca, the place of his residence, to the Roman camp, in order to confer with Bestia and Scaurus, and the preliminaries of the treaty being immediately after settled between them in private conferences, every body at Rome was convinced that the prince of the senate and the consul had to their avarice sacrificed the republic. The indignation thereof of the people in general displayed itself in the strongest manner. Memmius also fired them with his speeches. It was therefore resolved to despatch the prætor Cassius, a person they could confide in, to Numidia, to prevail upon Jugurtha to come to Rome, that they might learn from the king himself which of their generals and senators had been seduced by the pestilent influence of corruption. Upon his arrival there, he found means to bribe one Bæbius Salca, a man of great authority amongst the plebeians, but of insatiable avarice, by whose assistance he escaped with impunity. Nay, by the efficacy of gold, he not only eluded all the endeavours of the people of Rome to bring him to justice, but likewise enabled [illegible], one of his attendants, to get Massiva, an [illegible] son of Micipsa, assassinated in the streets [illegible]. That young prince was advised by many [illegible] of probity, wellwishers to the family of [illegible] to apply for the kingdom of Numidia; which coming to Jugurtha's ears, he prevented the application by this execrable step. However, he was obliged to leave Italy immediately.

Jugurtha had scarce set foot in Africa, when he received advice that the senate had annulled the shameful peace concluded with him by Bestia and Scaurus. Soon after, the consul Albinus transported a Roman army into Numidia, flattering himself with the hopes of reducing Jugurtha to reason before the expiration of his consulate. In this, however, he found himself deceived; for that crafty prince, by various artifices so amused and imposed upon Albinus, that nothing of moment happened that campaign. This rendered him strongly suspected of having betrayed his country, after the example of his predecessors. His brother Aulus, who succeeded him in the command of the army, was still more unsuccessful; for after rising from before Suthul, where the king's treasures were deposited, he marched his forces into a defile out of which he found it impossible to extricate himself. He therefore was obliged to submit to the ignominious ceremony of passing under the *jugum*, with all his men, and to quit Numidia entirely in ten days time, in order to deliver his troops from immediate destruction. The avaricious disposition of the Roman commander had prompted him to besiege Suthul, the possession of which place he imagined would make him master of all the wealth of Jugurtha, and consequently paved the way to such a scandalous treaty. However, this was declared void as soon as known at Rome, as being concluded without the authority of the people. The Roman troops retired into Africa Propria, which they had now reduced into the form of a Roman province, and the[illegible] took up their winter quarters.

In the mean time Caius Mamilius Limetanus, tribune of the people, excited the plebeians to inquire into the conduct of those persons by whose assistance Jugurtha had found means to elude all the decrees of the senate. This put the body of the people into a great ferment, which occasioned a prosecution of the guilty senators, that was carried on, for some time, with the utmost heat and violence. Lucius Metellus the consul, during these transactions, had Numidia assigned him for his province, and consequently was appointed general of the army destined to act against Jugurtha. As he perfectly disregarded wealth, the Numidian found him superior to all his temptations; which was a great mortification to him. To this he joined all the other virtues which constitute the great captain; so that Jugurtha found him in all respects inaccessible. That prince therefore was now forced to regulate his conduct according to the motions of Metellus, with the greatest caution; and to exert his utmost bravery, in order to compensate for that hitherto so favourable expedient which now began to fail him. Marius, Metellus's lieutenant, being likewise a person of uncommon merit, the Romans reduced Vacca, a large opulent city, and the most celebrated mart in Numidia. They also defeated Jugurtha in a pitched battle; overthrew Bomilcar, one of his generals, upon the banks of the Muthullus; and, in fine, forced the Numidian monarch to take shelter in a place rendered almost inaccessible by the rocks and woods with which it was covered. However, Jugurtha signalized himself in a surprising manner, exhibiting all that could be expected from the courage, abilities, and attention of a consummate general, to whom despair administers fresh strength, and suggests new lights. But his troops could not make head against the Romans; they were again worsted by Marius, though they obliged Metellus to raise the siege of Zama. Jugurtha therefore, finding his country everywhere ravaged, his most opulent cities plundered, his fortresses reduced, his towns burnt, vast numbers of his subjects put to the sword and taken prisoners, began to think seriously of coming to an accommodation with the Romans. His favourite Bomilcar, in whom he reposed the highest confidence, but who had been gained over to the enemy by Metellus, observing this disposition, found it no difficult matter to persuade him to deliver up his elephants, money, arms, horses, and deserters, in whom the main strength of his army consisted, into the hands of the Romans. Some of these last, in order to avoid the punishment due to their crime, retired to Bocchus king of Mauritania, and listed in his service. But Metellus ordering him to repair to Tisidium, a city of Numidia, there to receive farther directions, and he refusing a compliance with that order, hostilities were renewed with greater fury than ever. Fortune now seemed to declare in favour of Jugurtha: he retook Vacca, and massacred all the Roman garrison, except Turpilius the commandant. However, soon after, a Roman legion seized again upon it, and treated the inhabitants with the utmost severity. About this time, one of Mastanabal's sons, named *Gauda*, whom Micipsa in his will had appointed to succeed to the crown in case his two legitimate sons and Jugurtha died without [illegible] to the senate in favour of Marius, who [illegible] to supplant Metellus. That prince [illegible] standing impaired by a declining state of [illegible] a more easy prey to the base and infamous adulation of Marius. The Roman, soothing his vanity, assured him, that as he was the next heir to the crown, he might depend upon being fixed

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12 Metellus sent against Jugurtha.

13 Who is betrayed by Bomilcar.

Numidia.

fixed upon the Numidian throne, as ſoon as Jugurtha was either killed or taken; and that this would in a ſhort time happen, when once he appeared at the head of the Roman army with an unlimited commiſſion.

14 A conſpiracy againſt him.

Soon after, Bomilcar and Nabdalſa formed a deſign to aſſaſſinate Jugurtha, at the inſtigation of Metellus; but this being detected, Bomilcar and moſt of his accomplices ſuffered death. The plot however had ſuch an effect upon Jugurtha, that he enjoyed afterwards no tranquillity or repoſe. He ſuſpected perſons of all denominations, Numidians as well as foreigners, of ſome black deſigns againſt him. Perpetual terrors ſat brooding over his mind; inſomuch that he never got a wink of ſleep but by ſtealth, and often changed his bed in a low plebeian manner. Starting from his ſleep, he would frequently ſnatch his ſword, and break out into the moſt doleful cries: So ſtrongly was he haunted by a ſpirit of fear, jealouſy, and diſtraction!

Jugurtha having deſtroyed great numbers of his friends on ſuſpicion of their having been concerned in the late conſpiracy, and many more of them deſerting to the Romans and Bocchus king of Mauritania, he found himſelf, in a manner, deſtitute of counſellors, generals, and all perſons capable of aſſiſting him in carrying on the war. This threw him into a deep melancholy, which rendered him diſſatisfied with every thing, and made him fatigue his troops with a variety of contradictory motions. Sometimes he would advance with great celerity againſt the enemy, and at others retreat with no ſmall ſwiftneſs from them. Then he reſumed his former courage; but ſoon after deſpaired either of the valour or fidelity of the forces under his command. All his movements therefore proved unſucceſsful, and at laſt he was forced by Metellus to a battle. That part of the Numidian army which Jugurtha commanded, behaved with ſome reſolution; but the other fled at the firſt onſet. The Romans therefore entirely defeated them, took all their ſtandards, and made a few of them priſoners. But few of them were ſlain in the action; ſince, as Salluſt obſerves, the Numidians truſted more to their heels than to their arms for ſafety in this engagement.

15 He is defeated by Metellus.

Metellus purſued Jugurtha and his fugitives to Thala. His march to this place being through vaſt deſerts, was extremely tedious and difficult. But being ſupplied with leathern bottles and wooden veſſels of all ſizes taken from the huts of the Numidians, which were filled with water brought by the natives, who had ſubmitted to him, he advanced towards that city. He had no ſooner begun his march, than a moſt copious ſhower of rain, a thing very uncommon in thoſe deſerts, proved a great and ſeaſonable refreſhment to his troops. This ſo animated them, that upon their arrival before Thala, they attacked the town with ſuch vigour, that Jugurtha with his family, and treaſures depoſited therein, thought proper to abandon it. After a brave defence, it was reduced; the garriſon, conſiſting of Roman deſerters, ſetting fire to the king's palace, and conſuming themſelves, together with every thing valuable to them, in the [illegible] gurtha, being now reduced to [illegible] tired [illegible] innumerable [illegible] to the confines of Mauritania; and engaged Bocchus king of that country, who had married his daughter, to enter into an alliance with him. In conſequence of which, having reinforced his Gætulian troops with a powerful body of Mauritanians, he turned the tables upon Metellus, and obliged him to keep cloſe within his entrenchments. Salluſt informs us, that Jugurtha bribed Bocchus's miniſters to influence that prince in his favour; and that having obtained an audience, he inſinuated, that, ſhould Numidia be ſubdued, Mauritania muſt be involved in its ruin, eſpecially as the Romans ſeemed to have vowed the deſtruction of all the thrones in the univerſe. In ſupport of what he advanced, he produced ſeveral inſtances very appoſite to the point in view. However, the ſame author ſeems to intimate, that Bocchus was determined to aſſiſt Jugurtha againſt his enemies by the ſlight the Romans had formerly ſhown him. That prince, at the firſt breaking out of the war, had ſent ambaſſadors to Rome, to propoſe an offenſive and defenſive alliance to the republic; which, though of the utmoſt conſequence to it at the juncture, a few of the moſt venal and infamous ſenators, who were abandoned to corruption, prevented it from taking effect. This undoubtedly wrought more powerfully upon Bocchus in favour of Jugurtha, than the relation he ſtood in to him: For both the Moors and Numidians adapted the number of their wives to their circumſtances, ſo that ſome had 10, 20, &c. to their ſhare; their kings therefore were unlimited in this particular, and of courſe all degrees of affinity reſulting to them from marriage had little force. It is obſervable, that the poſterity of thoſe ancient nations have the ſame cuſtom prevailing amongſt them at this day.

16 Marius ſucceeds Metellus.

Such was the ſituation of affairs in Numidia, when Metellus received advice of the promotion of Marius to the conſulate. But, notwithſtanding this injurious treatment, he generouſly endeavoured to draw off Bocchus from Jugurtha, though this would facilitate the reduction of Numidia for his rival. To this end ambaſſadors were deſpatched to the Mauritanian court, who intimated to Bocchus, "That it would be highly imprudent to come to a rupture with the Romans without any cauſe at all; and that he had now a fine opportunity of concluding a moſt advantageous treaty with them, which was much preferable to a war. To which they added, that whatever dependence he might place upon his riches, he ought not to run the hazard of loſing his dominions by embroiling himſelf with other ſtates, when he could eaſily avoid this; that it was much eaſier to begin a war than to end it, which it was in the power of the victor alone to do; that, in fine, he would by no means conſult the intereſt of his ſubjects if he followed the deſperate fortunes of Jugurtha." To which Bocchus replied, "That for his part there was nothing he wiſhed for more than peace; but that he could not help pitying the deplorable condition of Jugurtha; that if the Romans, therefore, would grant that unfortunate prince the ſame terms they had offered him, he would bring about an accommodation." Metellus, let the Mauritanian monarch know, that it was not in his power to comply with what he deſired. However, he took care to keep up a private negotiation with him till the new conſul Marius's arrival. By this conduct he ſerved two wiſe ends. Firſt, He prevented thereby Bocchus from coming to a general action with his troops;

Numidia troops; which was the very thing Jugurtha desired, as hoping that this, whatever the event might be, would render a reconciliation betwixt him and the Romans impracticable. Secondly, This inaction enabled him to discover something of the genius and disposition of the Moors; a nation of whom the Romans, till then, had scarce formed any idea; which, he imagined, might be of no small service, either to himself or his successors, in the future prosecution of the war.

Jugurtha, being informed that Marius, with a numerous army, was landed at Utica, advised Bocchus to retire, with part of the troops, to some place of difficult access, whilst he himself took post upon another inaccessible spot with the remaining corps. By this measure, he hoped the Romans would be obliged to divide their forces, and consequently be more exposed to his efforts and attacks. He likewise imagined, that seeing no formidable body appear, they would believe the enemy in no condition to make head against them; which might occasion a relaxation of discipline, the usual attendant of a too great security, and consequently produce some good effects. However, he was disappointed in both these views. For Marius, far from suffering a relaxation of discipline to take place, trained up his troops, which consisted chiefly of new levies, in so perfect a manner, that they were soon equal in goodness to any consular army that ever appeared in the field. He also cut off great numbers of the Gætulian marauders, defeated many of
17 Jugurtha's parties, and had like to have taken that
He gains a great advantage over Jugurtha. prince himself near the city of Cirta. These advantages, though not of any great importance, intimidated Bocchus, who now made overtures for an accommodation; but the Romans, not being sufficiently satisfied of his sincerity, paid no great attention to them. In the mean time Marius pushed on his conquests, reducing several places of less note, and at last resolved to besiege Capsa. That this enterprise might be conducted with the greater secrecy, he suffered not the least hint of his design to transpire, even amongst any of his officers. On the contrary, in order to blind them, he detached A. Manlius, one of his lieutenants, with some light-armed cohorts, to the city of Lares, where he had fixed his principal magazine, and deposited the military chest. Before Manlius left the camp, that he might the more effectually amuse him, he intimated, that himself with the army should take the same route in a few days: but instead of that, he bent his march towards the Tanais, and in six days time arrived upon the banks of that river. Here he pitched his tents for a short time, in order to refresh his troops; which having done, he advanced to Capsa, and made himself master of it. As the situation of this city rendered it extremely commodious to Jugurtha, whose plan of operations, ever since the commencement of the war, it had exceedingly favoured, he levelled it with the ground after it had been delivered up to the soldiers to be plundered. The citizens likewise, being more strongly attached to that prince than any of the other Numidians, on account of the extraordinary privileges he indulged them with, and of course bearing a more implacable hatred to the Romans, he put to the sword or sold for slaves. The true motive of the consul's conduct on this occasion seems here to be assigned; though we are told by Sallust, in conformity to the Roman genius, that neither avarice nor resentment prompted him to so barbarous an action, but only a desire to strike a terror into the Numidians. Numidia.

The Numidians, ever after this exploit, dreaded the very name of Marius; who now, in his own opinion, had eclipsed the glory of all his predecessor's great achievements, particularly the reduction of Thala, a city, in strength and situation, nearly resembling Capsa. Following this blow, he gradually presented himself before most of the places of strength in the enemy's country; many of which either opened their gates, or were abandoned, at his approach, being terrified with what had happened to the unfortunate citizens of Capsa. Others taken by force, he laid in ashes; and in [illegible] filled the greatest part of Numidia with blood, [illegible] and confusion. Then, after an obstinate defence, he reduced a castle that seemed impregnable, seated not far from Mulucha, where Jugurtha kept part of his treasures. In the mean time, Jugurtha not being able to prevail upon Bocchus, by his repeated solicitations, to advance into Numidia, where he found himself greatly pressed, was obliged to have recourse to his usual method of bribing the Mauritanian ministers, in order to put that prince in motion. He also promised him a third part of his kingdom, provided they could either drive the Romans out of Africa, or get all the Numidian dominions confirmed to him by treaty.

So considerable a cession could not fail of engaging Bocchus to support Jugurtha with his whole power. The two African monarchs therefore, having joined their forces, surprised Marius near Cirta as he was going into winter quarters. The Roman general was so pushed on this occasion, that the barbarians thought themselves certain of victory, and doubted not but they should be able to extinguish the Roman name in Nu- 18
midia. But their incaution and too great security enabled Marius to give them a total defeat; which was followed four days after by so complete an overthrow, that their numerous army, consisting of 90,000 men, by the accession of a powerful corps of Moors, commanded by Bocchus's son Volux, was entirely ruined. Jugurtha entirely defeated. Sylla, Marius's lieutenant, most eminently distinguished himself in the last action, which laid the foundation of his future greatness. Bocchus, now looking upon Jugurtha's condition as desperate, and not being willing to run the risk of losing his dominions, showed a disposition to clap up a peace with Rome. However, the republic gave him to understand, that he must not expect to be ranked amongst its friends, till he had delivered up into the consul's hands Jugurtha, the inveterate enemy of the Roman name. The Mauritanian monarch, having entertained a high idea of an alliance with that state, resolved to satisfy it in this particular; and was confirmed in his resolution by one Dabar, a Numidian prince, the son of Massugrada, and descended by his mother's side from Masinissa. Being closely attached to the Romans, and extremely agreeable to Bocchus on account of his noble disposition, he defeated all the intrigues of Aspar, Jugurtha's minister. Upon Sylla's arrival at the Mauritanian court, the affair there seemed to be entirely settled. However, Bocchus, who was for ever projecting new designs,

Numidia.

designs, and, like the rest of his countrymen, in the highest degree perfidious, debated within himself, whether he should sacrifice Sylla or Jugurtha, who were both then in his power. He was a long time fluctuating with uncertainty, and combated by a contrariety of sentiments. The sudden changes which displayed themselves in his countenance, his air, and his whole person, evidently showed how strongly his mind was agitated. But at last he returned to his first design, to which the bias of his mind seemed naturally to lead him. He therefore delivered up Jugurtha into the hands of Sylla, to be conducted to Marius; who, by that successful event, happily terminated this dangerous war. The kingdom of Numidia was now reduced to a new form: Bocchus, for his important services, had the country of the Massæsyli, contiguous to Mauritania, assigned him: which, from this time, took the name of *New Mauritania*. Numidia Propria, or the country of the Massyli, was divided into three parts; one of which was given to Hiempsal, another to Mandrestal, both descendants of Masinissa; and the third the Romans annexed to Africa Propria, or the Roman province adjacent to it. What became of Jugurtha after he had graced Marius's triumph, at which ceremony he was led in chains, together with his two sons, through the streets of Rome, we have already laid before our readers. See JUGURTHA.

20 Transactions after the death of Jugurtha.

Jugurtha's two sons survived him, but spent their lives in captivity at Venusia. However, one of them, named *Oxyntas*, was, for a short time, released from his confinement by Aponius, who besieged Acerræ in the war between the Romans and the Italian allies. That general brought this prince to his army, where he treated him as king, in order to draw the Numidian forces off from the Roman service. Accordingly those Numidians no sooner heard that the son of their old king was fighting for the allies, than they began to desert by companies; which obliged Julius Cæsar the consul to part with all his Numidian cavalry, and send them back into Africa. Some few years after this event, Pompey defeated Cneius Domitius Ahenobarbus, and Hiarbas one of the kings of Numidia, killing 17,000 of their men upon the spot. Not satisfied with this victory, that general pursued the fugitives to their camp, which he soon forced, put Domitius to the sword, and took Hiarbas prisoner. He then reduced that part of Numidia which belonged to Hiarbas, who seems to have succeeded Mandrestal above-mentioned; and gave it to Hiempsal, a neighbouring Numidian prince, descended from Massinissa, who had always opposed the Marian faction.

21 Cæsar insults Juba.

Suetonius informs us, that a dispute happened between Hiempsal and one Masintha, a noble Numidian, whom, it is probable, he had in some respect injured when Julius Cæsar first began to make a figure in the world. The same author adds, that Cæsar warmly espoused the cause of Masintha, and even grossly insulted Juba, Hiempsal's son, when he attempted to vindicate his father's conduct on this occasion. He pulled him by the beard, than which a more unpardonable affront could not be offered to an African. In short, he screened Masintha from the insults and violence of his enemies; from whence a reason may be assigned for Juba's adhering so closely afterwards to the Pompeian faction.

22 Juba defeats one of Cæsar's lieutenants.

In consequence of the indignity Cæsar had offered Juba, and the disposition it had occasioned, that prince did Cæsar great damage in the civil wars betwixt him and Pompey. By a stratagem he drew Curio, one of his lieutenants, into a general action, which it was his interest at that time to have avoided. He caused it to be given out all over Africa Propria and Numidia, that he was retired into some remote country at a great distance from the Roman territories. This coming to Curio's ears, who was then besieging Utica, it hindered him from taking the necessary precautions against a surprise. Soon after, the Roman general receiving intelligence that a small body of Numidians was approaching his camp, he put himself at the head of his forces in order to attack them, and, for fear they should escape, began his march in the night, looking upon himself as sure of victory. Some of their advanced posts he surprised asleep, and cut them to pieces; which still farther animated him. In short, about day break he came up with the Numidians, whom he attacked with great bravery, though his men were then fasting, and vastly fatigued by their forced and precipitate march. In the mean time, Juba, who, immediately after the propagation of the rumour above mentioned, had taken care to march privately, with the main body of the Numidian army, to support the detachment sent before to decoy Curio, advanced to the relief of his men. The Romans had met with a great resistance before he appeared; so that he easily broke them, killed Curio, with a great part of his troops, upon the spot, pursued the rest to their camp, which he plundered, and took many of them prisoners. Most of the fugitives, who endeavoured to make their escape on board the ships in the port of Utica, were either slain by the pursuers, or drowned. The remainder fell into the hands of Varus, who would have saved them; but Juba, who arrogated to himself the honour of this victory, ordered most of them to be put to the sword.

23 Juba overthrown by Cæsar.

This victory infused new life and vigour into the Pompeian faction, who thereupon conferred great honours upon Juba, and gave him the title of *king of all Numidia*. But Cæsar and his adherents declared him an enemy to the state of Rome, adjudging to Bocchus and Bogud, two African princes entirely in their interest, the sovereignty of his dominions. Juba afterwards, uniting his forces with those of Scipio, reduced Cæsar to great extremities, and would in all probability have totally ruined him, had he not been relieved by Publius Sittius. That general, having formed a considerable corps, consisting of Roman exiles, and Mauritanian troops sent him by Bocchus, according to Dio, or, as Cæsar will have it, Bogud, made an irruption into Gætulia and Numidia, whilst Juba was employed in Africa Propria. As he ravaged these countries in a dreadful manner, Juba immediately returned with the best part of his army, to preserve them from utter destruction. However, Cæsar knowing his horse to be afraid of the enemy's elephants, did not think proper to attack Scipio in the absence of the Numidian, till his own elephants, and a fresh reinforcement of troops, hourly expected, arrived from Italy,

Numitor || Nun.

Numidia. Italy. With this accession of strength, he imagined himself able to give a good account, both of the Roman forces with which he was to cope, and the barbarians. In the mean time Scipio despatched reiterated expresses to Juba to hasten to his assistance; but could not prevail upon him to move out of Numidia, till he had promised him the possession of all the Roman dominions in Africa, if they could from thence expel Cæsar. This immediately put him in motion; so that, having sent a large detachment to make head against Sittius, he marched with the rest of his troops to assist Scipio. However, Cæsar at last overthrew Scipio, Juba, and Labienus, near the town of Thapsus, and forced all their camps. As Scipio was the first surprised and defeated, Juba fled into Numidia without waiting for Cæsar's approach; but the body of the Numidians detached against Sittius, having been broken and dispersed by that general, none of his subjects there would receive him. Abandoned therefore to despair, he sought death in a single combat with Petreius, and having killed him, caused himself to be dispatched by one of his slaves.

24 Numidia reduced to the form of a province. After this decisive action, and the reduction of Africa Propria, Cæsar made himself master of Numidia, which he reduced to a Roman province, appointing Crispus Sallustius to govern it in quality of proconsul, with private instructions to pillage and plunder the inhabitants, and, by that means, put it out of their power ever to shake off the Roman yoke. However, Bocchus and Bogud still preserved a sort of sovereignty in the country of the Massæsyli and Mauritania, since the former of those princes, having deserted Cæsar, sent an army into Spain to assist the Pompeians; and the latter, with his forces, determined victory to declare for Cæsar at the ever memorable battle of Munda. Bogud, afterwards siding with Antony against Octavius, sent a body of forces to assist him in Spain; at which time the Tingitanians revolting from him, Bocchus, with an army composed of Romans in the interest of Octavius, who passed over from Spain into Africa, and his own subjects, possessed himself of Mauritania Tingitana. Bogud fled to Antony; and Octavius, after the conclusion of the war, honoured the inhabitants of Tingi with all the privileges of Roman citizens. He likewise confirmed Bocchus king of Mauritania Cæsariensis, or the country of the Massæsyli, *in* the possession of Tingitania, which he had conquered, as a reward for his important services. In this he imitated the example of his great predecessor Julius Cæsar, who divided some of the fruitful plains of Numidia among the soldiers of P. Sittius, who had conquered great part of that country, and appointed Sittius himself sovereign of that district. Sittius, as has been intimated above, having taken Cirta, killed Sabura, Juba's general, entirely dispersed his forces, and either cut off or taken prisoners most of the Pompeian fugitives that escaped from the battle of Thapsus, highly deserved to be distinguished in so eminent a manner. After Bocchus's death, Mauritania and th Massæsylian Numidia were in all respects considered Roman provinces.

NUMISMATOGRAPHIA, a term used for the description and knowledge of ancient coins and medals, whether of gold, silver, or brass. See COINS and MEDALS.

NUMITOR, the son of Procas king of Alba, and the brother of Amulius. Procas before his death made him and Amulius joint heirs to the crown, on condition of their reigning annually by turns: but Amulius, on getting possession of the throne, excluded Numitor, whose son Lausus he ordered to be put to death, and obliged Rhea Sylvia, Numitor's only daughter, to become a vestal. This princess becoming pregnant, declared that she was with child by the god Mars; and afterwards brought forth Remus and Romulus, who at length killed Amulius, and restored Numitor to the throne [illegible] C. See REMUS and ROMULUS.

[illegible] a piece of money otherwise called [illegible]

NUN, the son of Elishamah, and father of Joshua, of the tribe of Ephraim. The Greeks gave him the name of *Nane* instead of Nun. This man is known in sacred history only by being the father of Joshua.

NUN, a woman, in several Christian countries, who devotes herself, in a cloister or nunnery, to a religious life. See the article MONK.

There were women, in the ancient Christian church, who made public profession of virginity, before the monastic life was known in the world, as appears from the writings of Cyprian and Tertulian. These, for distinction's sake, are sometimes called *ecclesiastical virgins*, and were commonly enrolled in the canon or matricula of the church. They differed from the monastic virgins chiefly in this, that they lived privately in their fathers houses, whereas the others lived in communities: but their profession of virginity was not so strict as to make it criminal for them to marry afterwards, if they thought fit. As to the consecration of virgins, it had some things peculiar in it: it was usually performed publicly in the church by the bishop. The virgin made a public profession of her resolution, and then the bishop put upon her the accustomed habit of sacred virgins. One part of this habit was a veil, called the *sacrum velamen*; another was a kind of mitre or coronet worn upon the head. At present, when a woman is to be made a nun, the habit, veil, and ring of the candidate are carried to the altar; and she herself, accompanied by her nearest relations, is conducted to the bishop, who, after mass and an anthem, (the subject of which is, "that she ought to have her lamp lighted, because the bridegroom is coming to meet her)," pronounces the benediction: then she rises up, and the bishop consecrates the new habit, sprinkling it with holy water. When the candidate has put on her religious habit, she presents herself before the bishop, and sings, on her knees, *Ancilla Christi sum*, &c.; then she receives the veil, and afterwards the ring, by which she is married to Christ; and lastly, the crown of virginity. When she is crowned, an anathema is denounced against all who shall attempt to make her break her vows. In some few instances, perhaps, it may have happened that nunneries, monasteries, &c. may have been useful as well to morality and religion as to literature: in the gross, however, they have been highly prejudicial; and however well they might be supposed to do when viewed in theory, in fact they are unnatural and impious. It was surely far from the intention of Providence to seclude youth and beauty in a cloistered ruin, or to deny them the innocent enjoyment [illegible] years and sex.

NUNCIO,

Nuncio || Monte

NUNCIO, or NUNTIO, an ambassador from the pope to some Catholic prince or state, or a person who attends on the pope's behalf at a congress, or an assembly of several ambassadors.

NUNCUPATIVE, in the schools, something that is only nominal, or has no existence but in name.

*Nuncupative Will* or *Testament*, a will made verbally, and not put in writing. See the articles WILL and TESTAMENT.

NUNDINA, a goddess among the ancient heathens, supposed to have the care of the purification of infants. And because male infants were purified nine days after their birth, her name is derived from *nonus*, or the ninth, though female infants were purified the eighth day; which purification was called *lustration* by the Romans.

NUNDINAL, *Nundinalis*, a name which the Romans gave to the eight first letters of the alphabet used in their kalendar.

This series of letters, A, B, C, D, E, F, G, H, is placed and repeated successively from the first to the last day of the year: one of these always expressed the market days, or the assemblies called *nundinæ, quasi novendinæ*, because they returned every nine days. The country people, after working eight days successively, came to town the ninth, to sell their several commodities, and to inform themselves of what related to religion and government. Thus the nundinal day being under A on the first, ninth, seventeenth, and twenty fifth days of January, &c. the letter D will be the nundinal letter of the year following. These nundinals bear a very great resemblance to the dominical letters, which return every eight days, as the nundinal did every nine.

NUNDOCOMAR, a Rajah in Bengal, and head of the Bramins, who, in 1775, was condemned to an ignominious death by English laws newly introduced in an English court of justice newly established, for a forgery charged to have been committed by him many years before. That he was guilty of the deed cannot be questioned; but there was surely something hard in condemning a man by an *ex post facto* law. He bore his fate with the utmost fortitude, in the full confidence that his soul would soon be reunited to the universal spirit whence it had sprung. See METAPHYSICS, Part III. Ch. IV. *Of the Immortality of the Soul*.

*Monte Nuovo*, in the environs of Naples, blocks up the valley of Averno. "This mountain (Mr Swinburne tells us) arose in the year 1538, for after repeated quakings, the earth burst asunder, and made way for a deluge of hot ashes and flames, which rising extremely high, and darkening the atmosphere, fell down again and formed a circular mound four miles in circumference, and 1000 feet high, with a large cup in the middle. The wind rising afterwards, wafted the lighter particles over the country, blasted vegetation, and killed the animals who grazed; the consequence was, that the place was deserted, till Don Pedro de Toledo, viceroy of Naples, encouraged the inhabitants by example and otherwise to return.

"Part of Monte Nuovo is cultivated, but the larger portion of its declivity is wildly overgrown with prickly broom, and rank weeds that emit a very fetid sulphureous smell. The crater is shallow, its inside clad with shrubs, and the little area at the bottom planted with fig and mulberry trees; a most striking specimen of the amazing vicissitudes that take place in this extraordinary country. I saw no traces of lava or melted matter, and few stones within.

"Near the foot of this mountain the subterraneous fires act with such immediate power, that even the sand at the bottom of the sea is heated to an intolerable degree."

Nuptial, Nuremberg.

NUPTIAL RITES, the ceremonies attending the solemnization of marriage, which are different in different ages and countries. We cannot omit here a custom which was practised by the Romans on these occasions; which was this: Immediately after the chief ceremonies were over, the new married man threw *nuts* about the room for the boys to scramble for. Various reasons have been assigned for it; but that which most generally prevails, and seems to be the most just, is, that by this act the bridegroom signified his resolution to abandon trifles, and commence a serious course of life; whence *nucibus relictis* in this sense became a proverb. They might also be an emblem of fertility.

The ancient Greeks had a person to conduct the bride from her own to the bridegroom's house, and hence he was called by the Greeks *Nymphagog*, which term was afterwards used both by the Romans and the Jews.

NUREMBERG, an imperial city of Germany, capital of a territory of the same name, situated in E. Long. 11°, N. Lat. 47. 30. It stands on the Regnitz, over which it has several bridges, both of wood and stone, at the bottom of a hill, 60 miles from Augsburg, 87 from Munich, 46 from Wurtzburg, and 50 from Ratisbon; and is thought by some to be the Segodunum, and by others the Castrum Noricum of the ancients.

The city has derived its name from the hill, upon which stands the castle, called, in Latin, Castrum Noricum, round which the city was begun to be built; and where the emperors formerly lodged, and here they lodge still, when they pass by that city. They there preserve, as precious relicks, the crown, sceptre, clothes, buskins, and other ornaments of Charlemagne (A), which served also the emperor Leopold, when he went thither after his election, to receive the homage of the city. The small river Regnitz, which runs through it, and those of Rednitz and Schwabach, which pass by its walls, furnish the inhabitants, besides other advantages, with the means of making all sorts of stuffs, dyes, and other manufactures (B).



and

(A) These ornaments are, a mitred crown, enriched with rubies, emeralds, and pearls; the dalmatic of Charlemagne, richly embroidered; the imperial mantle powdered with embroidered eagles, and its border thick set with large emeralds, sapphires, and topazes; the buskins covered with plates of gold; the gloves embroidered; the apple, the golden sceptre, and sword. The ancient custom of the empire is, that the emperor is bound to assemble in this city the first diet that he holds after his election and coronation.

(B) There is in Nuremberg, and in the neighbouring villages depending upon it, an infinite number of workmen

Nuremberg.

and toys, which are carried and sold even in the Indies.

It is a large and well built town, but not very populous. Its fortifications are a double wall, flanked with towers mounting cannon, and a deep ditch. The magistrates, and most of the inhabitants, are Lutherans. There are a great many churches and chapels in it. In that of St Sebald is a brass monument of the saint; and a picture, representing the creation of the world, by the celebrated Albert Durer, who was a native of the town; but the finest church in the town is that of St Giles. In that of the Holy Ghost are kept most of the jewels of the empire, together with the pretended spear with which our Saviour's side was pierced, a thorn of his crown, and a piece of the manger wherein he was laid. Here are also a great many hospitals, one in particular for foundlings, and another for pilgrims; with a gymnasium, an anatomical theatre, a granary, a fine public library, the old imperial fortress or castle, some remains of the old citadel of the burgraves of Nuremberg, several Latin schools, an academy of painting, a well furnished arsenal, a Teutonic house in which the Roman Catholic service is tolerated, and a mint. Mr Keysler says, there are upwards of 500 streets in it, about 140 fountains, 16 churches, 44 religious houses, 12 bridges, 10 market places, and 25,000 inhabitants; and that its territories, besides the capital and four other towns, contain above 500 villages, and about 160 mills on the Regnitz. The trade of this city, though upon the decline, is still very great, many of its manufactures being still exported to all parts of the world; among which may be reckoned a great variety of curious toys in ivory, wood, and metal, already mentioned. The city has also distinguished itself in the arts of painting and engraving. When the emperor Henry VI. assisted at a tournament in Nuremberg, he raised 38 burghers to the degree of nobility, the descendants of whom are called *patricians*, and have the government of the city entirely in their hands; the whole council, except eight masters of companies, who are summoned only on extraordinary occasions, consisting of them. Among the fine brass cannon in the arsenal, is one that is charged at the breech, and may be fired eight times in a minute; and two that carry balls of eighty pounds. The city keeps, in constant pay, seven companies, consisting each, in time of peace, of 100 men, but, in time of war, of 185; two troops of cuirassiers, each consisting of 85 men; and two companies of invalids. There are also 24 companies of burghers, well armed and disciplined. On the new bridge, which is said to have cost 100,000 guilders, are two pyramids, on the top of one of which is a dove with an olive branch in her bill, and on the other an imperial black eagle. Music also flourishes greatly in Nuremberg; and those who delight in mechanic arts and manufactures cannot anywhere better gratify their curiosity. As an imperial city, it has a seat and voice at the diets of the empire and circle, paying to the chamber of Wetzlar 812 rixdollars each term. The territory belonging to the city is pretty large, containing, besides two considerable forests of pine, called the *Sebald* and *Laurence forests*, several towns and villages.

Nuremberg || Nursing.

We have mentioned already that certain families called patricians, to the exclusion of the rest, possess the offices of the senate. They are composed of 42 persons (C), over which two castellans, or perpetual seneschals, preside, the first of whom has his residence in the castle. These castellans assemble sometimes in the castle, with five or six of the chief members, to hold a secret council (D). And, as this city glories in being one of the first which embraced Lutheranism, it preserves the privilege of that in civil matters, not admitting any Catholics to the magistracy or freedom of the town; the Catholics there having the liberty only of remaining under the protection of the rest, and performing their religious worship in a commandery of Malta, and this but at certain hours, not to disturb the Lutherans, who likewise assemble there, although in possession of all the other churches.

This city is particularly noted for its antiquity, grandeur, fortifications, its triple walls of hewn stone, its large and deep moat, its fine houses, large churches, its wide streets, always clean, and for its curious and large library, and its magazine stored with every thing proper for its defence.

NURSERY, in gardening, is a piece of land set apart for raising and propagating all sorts of trees and plants to supply the garden and other plantations.

NURSING OF CHILDREN. See LACTATIO.

The following observations are said to be the result of long experience †. A child, when it comes into the world, is almost a round ball; it is the nurse's part to assist nature, in bringing it to a proper shape. The child should be laid (the first month) upon a thin mattress, rather longer than itself, which the nurse will keep upon her lap, that the child may always lie straight, and only sit up as the nurse slants the mattress. To set a child quite upright before the end of the first month, hurts the eyes, by making the white part of the eye appear below the upper eyelid. Afterwards the nurse will begin to set it up and dance it by degrees. The child must be kept as dry as possible.

† An. Reg. Vol. VI. p. 130.

The clothing should be very light, and not much longer than the child, that the legs may be got at with ease, in order to have them often rubbed in the day

workmen, very ingenious in making several kinds of toys of wood, which are carried through all the fairs of Germany, and from thence through all Europe. These toys are called Nurembergs; and they have so great a sale, that it even exceeds description. This employment affords a livelihood to the greatest part of the inhabitants of the city; and they make a very considerable profit from this traffic.

(C) Of these 42 members, there are only 34 chosen from the patrician families; the other eight are taken from among the burghers, and make in a manner a small separate body.

(D) This secret council is composed of seven principal chiefs of the republic, and for that reason is called *septemvirate*. It determines the most important affairs; and is the depository of the precious stones of the empire, of the imperial crown, the ensigns, seals, and keys of the city.

Nursing.

day with a warm hand or flannel, and in particular the inside of them.

Rubbing a child all over takes off scurf, and makes the blood circulate. The one breast should be rubbed with the hands one way, and the other the other way, night and morning at least.

The ankle bones and inside of the knees should be rubbed twice a day; this will strengthen those parts, and make the child stretch its knees and keep them flat, which is the foundation of an erect and graceful person.

A nurse ought to keep a child as little in her arms as possible, lest the legs should be cramped, and the toes turned inwards. Let her always keep the child's legs loose. The oftener the posture is changed, the better.

Tossing a child about, and exercising it in the open air in fine weather, is of the greatest service. In cities, children are not to be kept in hot rooms, but to have as much air as possible.

Want of exercise is the cause of large heads, weak and knotted joints, a contracted breast, w sions coughs and stuffed lungs, an ill and waddling gait, besides a numerous train ills.

The child's flesh is to be kept perfectly clean, by constantly washing its limbs and likewise its neck and ears; beginning with warm water, till by degrees it will not only bear, but like to be washed with cold.

Rising early in the morning is good for all children, provided they awake of themselves, which they generally do: but they are never to be waked out of their sleep, and as soon as possible to be brought to regular sleeps in the day.

When laid in bed or cradle, their legs are always to be laid straight.

Children, till they are two or three years old, must never be suffered to walk long enough at a time to be weary.

Girls might be trained to the proper management of children, if a premium were given in free schools, workhouses, &c. to those that brought up the finest child to one year old.

If the mother cannot suckle the child, get a wholesome cheerful woman, with young milk, who has been used to tend young children. After the first six months, small broths, and innocent foods of any kind, may do as well as living wholly upon milk.

A principal thing to be always attended to is, to give young children constant exercise, and to keep them in a proper posture.

With regard to the child's dress in the day, let it be a shirt; a petticoat of fine flannel, two or three inches longer than the child's feet, with a dimity top (commonly called a *bodice coat*), to tie behind; over that a surcingle made of fine buckram, two inches broad, covered over with satin or fine ticken, with a ribbon fastened to it to tie it on, which answers every purpose of stays, and has none of their inconveniences. Over this put a robe, or a slip and frock, or whatever you like best; provided it is fastened behind, and not much longer than the child's feet, that their motions may be strictly observed.

Two caps are to be put on the head, till the child has got most of its teeth.

Nusance ‖ Nutcracker.

The child's dress for the night may be a shirt, a blanket to tie on, and a thin gown to tie over the blanket.

NUSANCE, or NUISANCE, in law, a thing done to the annoyance of another.

Nuisances are either public or private.—A public nuisance is an offence against the public in general, either by doing what tends to the annoyance of all the king's subjects, or by neglecting to do what the common good requires: in which case, all annoyances and injuries to streets, highways, bridges, and large rivers, as also disorderly alehouses, bawdy-houses, gaming houses, stages for rope-dancers, &c. are held to be common nuisances.—A private nuisance is, when only one person or family is annoyed by the doing of any thing; as where a person stops up the light of another's house, or builds in such a manner that the rain falls from his house upon his neighbour's.

NUT, among botanists, denotes a PERICARPIUM of an extraordinary hardness, enclosing a kernel or seed.

NUTATION, in astronomy, a kind of tremulous motion of the axis of the earth, whereby, in each annual revolution, it is twice inclined to the ecliptic, and as often returns to its former position.

NUTCRACKER. See CORVUS, N° 8.

Plate cccxlvii.

"This bird (says Buffon) is distinguished from the jays and magpies by the shape of its bill, which is straighter, blunter, and composed of two unequal pieces. Its instinct is also different; for it prefers the residence of high mountains, and its disposition is not so much tinctured with cunning and suspicion."

They live upon hazel nuts, acorns, wild berries, the kernels of pine tops, and even on insects.

"Besides the brilliancy of the plumage, the nutcracker is remarkable for the triangular white spots which are spread over its whole body, except the head. These spots are smaller on the upper part, and broader on the breast; their effect is the greater, as they are contrasted with the brown ground.

"These birds are most attached, as I have observed above, to mountainous situations. They are common in Auvergne, Savoy, Lorraine, Franche-Compté, Switzerland, the Bergamasque, in Austria, in the mountains which are covered with forests of pines. They also occur in Sweden, though only in the southern parts of that country. The people in Germany call them Turkey birds, Italian birds, African birds, which language means no more than that they are foreign.

"Though the nutcrackers are not birds of passage, they fly sometimes from the mountains to the plains. Frisch says, that flocks of them are often observed to accompany other birds into different parts of Germany, especially where there are pine forests. But in 1754, great flights of them entered France, particularly Burgundy, where there are few pines; they were so fatigued on their arrival, that they suffered themselves to be caught by the hand.

"We cannot find in writers of natural history any details with regard to their laying, their incubation, the training of their young, the duration of their life,

&c.

Nuthatch, Nutmeg.

&c. for they haunt inacceffible fpots, where they enjoy undifturbed fafety and felicity."

NUTHATCH, in ornithology. See SITTA, its generic name. In this place we fhall only extract from Buffon an account of two fpecies of foreign birds related to the nuthatch.

1. *The great hook-billed nuthatch.*—" It is the largeft of the known nuthatches: its bill, though pretty ftraight, is inflated at the middle, and a little hooked at the end; the noftrils are round; the quills of the tail and of the wings edged with orange on a brown ground; the throat white; the head and back gray; the under fide of the body whitifh. Such are the principal properties of the bird. It was obferved by Sloane in Jamaica.

" Its total length is about feven inches and a half; the bill is eight lines and one third; the upper mandible a little protuberant near the middle; the mid toe, eight lines and one third; the alar extent, eleven inches and a quarter; the tail about twenty-three lines."

Plate CCCXLVII. 2. *The fpotted* or *Surinam nuthatch.*—" This is another American nuthatch, with a hooked bill; but differs from the preceding in fize, plumage, and climate: it inhabits Dutch Guiana.

" The upper fide of the head and of the body is of a dull afh colour; the fuperior coverts of the wings of the fame colour, but terminated with white; the throat white; the breaft and all the under fide of the body cinereous, and more dilute than the upper fide, with white ftreaks fcattered on the breaft and fides, which forms a fort of fpeckling; the bill and legs brown.

" Total length, about fix inches; the bill, an inch; the *tarfus*, feven lines and a half; the mid toe, eight or nine lines, and longer than the hind toe, whofe nail is the ftrongeft; the tail, about eighteen lines, confifting of twelve nearly equal quills, and exceeds the wings thirteen or fourteen lines."

Plates CCCXXIV. and CCCXXV. NUTMEG. See MYRISTICA, its generic name. The tree which produces this fruit, was formerly thought to grow only in the Banda iflands. It is now paft a doubt, however, that it grows in the Ifle of France and in all or moft of the ifles of the South feas. It feems a little remarkable that this trade, which is certainly a lucrative one, fhould have been fo long monopolized by the Dutch. Their cunning and defire to retain it in their own hands feems to account for the idea that fo generally prevailed formerly that it grew only in their fettlements. It was reported as early as the year 1751, upon what appeared at that time to be good grounds, that it was likely to be produced in the Weft Indies. An Englifh failor faid he had feen fome trees in Jamaica, and the governor on inquiry found it fo, and that they agreed exactly with the defcription given of thofe in the Spice Iflands in the Eaft Indies. This account, which was given in the Gentleman's Magazine for January 1751, we have never feen confirmed; and therefore we fuppofe that the expectations formed were either fruftrated or premature: however, it is certain, as we have obferved under the generic name, that a wild fpecies of it grows at Tobago. To avoid repetition, or the appearance of prolixity, we muft refer thofe who wifh for farther information refpecting the trade in this article to M. P. Sonnerat's account of a voyage to the Spice Iflands and New Guinea, which was printed at Paris in 1775, and tranflated into Englifh and printed at Bury St Edmund's in 1781, &c. and to Bougainville's voyage, and Dr Hawkefworth's compilation of Englifh voyages.

Nutmeg, Nutrition.

It will not, however, we truft, be deemed improper, nor befide our purpofe, if we lay before our readers the following account of the dangerous confequences of using this article to excefs. It was given by Dr Jacob [illegible], publifhed in the Gentleman's Magazine for [illegible].

" A [illegible] of Lower Silefia, about thirty-fix years old, [illegible] a good conftitution, and who enjoyed a good [illegible] health, having felt, during fome days, fome [illegible], took it in his head, by way of remedy, [illegible] nutmegs, which weighed all together [illegible] ounces, and he drank, in eating them, fome glaffes [illegible], which he had no fooner done, but he was [illegible] a great heat, a violent pain in the head, a vertigo [illegible], and was inftantly deprived of the ufe of [illegible] fpeech, and of all his fenfes. He was put [illegible] where he remained two days and two nights [illegible] was oppreffed with laffitude, always drowfy, yet without being able to fleep. The third day he was in [illegible] lethargic ftate, which is called a *coma vigil*, with a weak and intermitting pulfe. Cephalic remedies, cordials, and among others the fpirit of cephalic vitriol, and the effence of caftoreum, were adminiftered in good fpirit of fal ammoniac. The fourth day he recovered a little, but had abfolutely loft his memory, fo as not to remember the leaft thing he had done in his life. A continued fever then came on, accompanied by an obftinate watchfulnefs; a palpitation of the heart feemed to be the forerunner of other fymptoms, and he was finally ftruck with a palfy in all his limbs.

" At the expiration of eight days, he recovered the ufe of reafon, and faid, that during the firft four days of his illnefs, he feemed to himfelf to have conftantly a thick veil before his eyes, and that a great number of fparks and flafhes continually iffued from it. All the bad fymptoms of this malady yielded at laft fucceffively to the continued ufe of remedies fuited to his condition; and in three months time he was perfectly recovered, but he was particularly indebted for his cure to mercurial and ammoniacal remedies.

" According to chemical principles, it might perhaps be faid, that the aromatic and oily falt contained in nutmeg, of which this patient had taken too large a dofe, had immediately excited fo great an agitation in the humours, and fo rapid a motion in the animal fpirits, as in fome meafure to partake of the nature of fire, and that a vifcid and narcotic fulphur, which refides likewife in the nutmeg, though in a lefs fenfible manner, being carried at the fame time into the mafs of blood, by fuddenly fixing the animal fpirits, and intercepting their courfe in the nerves, had afterwards caufed the ftupor in the limbs, the aphony, and the palfy. But I leave others to explain thefe phenomena; my only view, by communicating this obfervation, being to fhow that the immoderate ufe of nutmeg may be attended with very great danger."

NUTRITION, in the animal economy, is the repairing the continual lofs which the different parts of the body undergo. The motion of the parts of the body,

body, the friction of these parts with each other, and especially the action of the air, would destroy the body entirely, if the loss was not repaired by a proper diet, containing nutritive juices; which being digested in the stomach, and afterwards converted into chyle, mix with the blood, and are distributed through the whole body for its nutrition.

In young persons, the nutritive juices not only serve to repair the parts that are damaged, but also to increase them, which is called *growth*.

In grown persons, the cuticle is everywhere constantly desquamating, and again renewing; and in the same manner the parts rubbed off, or otherwise separated from the fleshy parts of the body, are thus supplied with new flesh; a wound [illegible] ciated person grows plump and fat.

Buffon, in order to account for nutrition, supposes the body of an animal or vegetable to be a kind of mould, in which the matter necessary to its nutrition is modelled and assimilated to the whole. But (continues he) of what nature is this matter which an animal or vegetable assimilates to its own substance? What power is it that communicates to this matter the activity and motion necessary to penetrate this mould? and, if such a force exist, would it not be by a similar force that the internal mould itself might be reproduced?

As to the first question, he supposes that there exists in nature an infinite number of living organical parts, and that all organized bodies consist of such organical parts; that their production costs nature nothing, since their existence is constant and invariable; so that the matter which the animal or vegetable assimilates to its substance, is an organical matter of the same nature with that of the animal or vegetable, which consequently may augment its volume without changing its form or altering the quality of the substance in the mould.

As to the second question: There exist (says he) in nature certain powers, as that of gravity, that have no affinity with the external qualities of the body, but act upon the most intimate parts, and penetrate them throughout, and which can never fall under the observation of our senses.

And as to the third question, he answers, that the internal mould itself is reproduced, not only by a similar power, but it is plain that it is the very same power that causes the unfolding and reproduction thereof: for it is sufficient (proceeds he), that in an organized body that unfolds itself, there be some part similar to the whole, in order that this part may one day become itself an organized body, altogether like that of which it is actually a part.

NUX MOSCHATA. See MYRISTICA and NUTMEG.

*Nux Pistachia*. See PISTACHIA.

*Nux Vomica*, a flat, compressed, round fruit, about the breadth of a shilling, brought from the East Indies. It is found to be a certain poison for dogs, cats, &c. and it is not to be doubted that it would also prove fatal to mankind. Its surface is not much corrugated; and its texture is firm like horn, and of a pale grayish-brown colour. It is said to be used as a specific against the bite of a species of water snake. It is considerably bitter and deleterious; but has been used in doses from five to ten grains twice a-day or so, in intermittents, particularly obstinate quartans, and in contagious dysentery. The *strychnos Ignatii* is a tree of the same kind producing gourd-like fruit, the seeds of which are improperly called St Ignatius's beans. These, as also the woods or roots of some such trees, called *lignum colubrinum* or *snakewood*, are very narcotic bitters like the nux vomica.



NUYTS (Peter), a native of Holland, and a leading character in that extraordinary transaction which happened between the Japanese and the Dutch about the year 1628. In 1627 Nuyts arrived in Batavia from Holland, and was in the same year appointed ambassador to the emperor of Japan by the governor and council of Batavia.

He repaired to that empire in 1628; and being a man of a haughty disposition, and extremely vain, he believed it practicable to pass upon the natives for an ambassador from the king of Holland. Upon his assuming this title he was much more honourably received, caressed, and respected, than former ministers had been. But he was soon detected, reprimanded, and reproached in the severest manner, sent back to the port, and ordered to return to Batavia with all the circumstances of disgrace imaginable; notwithstanding which, his interest was so great, that, instead of being punished as he deserved, he was immediately afterwards promoted to the government of the island of Formosa, of which he took possession the year following.

He entered upon the administration of affairs in that island with the same disposition that he had shown while ambassador, and with the most implacable resentment against the Japanese, neither was it long before an opportunity offered, as he thought, of revenging himself to the full. Two large Japanese ships, with upwards of five hundred men on board, came into the port; upon which he took it into his head to disarm and unrig them, in the same manner as the Dutch vessels are treated at Japan. The Japanese did all they could to defend themselves from this ill usage; but at last, for want of water, they were forced to submit. Governor Nuyts went still further. When they had finished their affairs at Formosa, and were desirous of proceeding, according to their instructions, to China, he put them off with fair words and fine promises till the monsoon was over. They began then to be very impatient, and desired to have their cannon and sails restored, that they might return home; but the governor had recourse to new artifices, and, by a series of false promises, endeavoured to hinder them from making use of the season proper for that voyage.

The Japanese, however, soon perceived his design; and at length, by a bold attempt, accomplished what by fair means and humble entreaty they could not obtain; for, by a daring and well concerted effort, they took him prisoner, and made him and one of the council sign a treaty for securing their liberty, free departure, and indemnity, which was afterwards ratified by the whole council. Nuyts was first confined in Batavia, and afterwards [illegible] up to the Japanese, notwithstanding the most earnest entreaties on his part to be tried, and even to suffer any kind of death where he was, rather than to be sent to Japan. He was sent there, however, in 1634. He was

submitted

submitted to the mercy or discretion of the emperor; and the consequence was, that, though imprisoned, he was well used, and could go anywhere, provided his guards were with him, which was more than he could possibly have expected. He now looked for nothing but the continuance of his confinement for life. On a particular occasion, however, i. e. at the funeral of the emperor's father, at the request of the Dutch he was set free, and returned again to Batavia, to the surprise of that people, who, however, adopted ever after a very different conduct with respect to the Japanese.

NUZZER, or NUZZERANAH; a present or offering from an inferior to a superior. In Hindostan no man ever approaches his superior for the first time on business without an offering of at least a gold or silver rupee in his right hand; which if not taken is a mark of disfavour. Nuzzeranah is also used for the sum paid to the government as an acknowledgment for a grant of lands or any public office.

NYCHTHEMERON, among the ancients, signified the whole natural day, or day and night, consisting of 24 hours, or 24 equal parts. This way of considering the day was particularly adopted by the Jews, and seems to owe its origin to that expression of Moses, in the first chapter of Genesis, "the evening and the morning were the first day."—Before the Jews had introduced the Greek language into their discourse, they used to signify this space of time by the simple expression of a night and a day.

It is proper here to observe, that all the eastern countries reckoned any part of a day of 24 hours for a whole day; and say a thing that was done on the third or seventh day, &c. from that last mentioned, was done after three or seven days. And the Hebrews, having no word which exactly answers to the Greek Νυχημερον, signifying "a natural day of 24 hours," use *night and day*, or *day and night*, for it. So that to say a thing happened after three days and three nights, was, with them, the same as to say it happened after three days, or on the third day. This, being remembered, will explain what is meant by "the Son of Man's being three days and three nights in the heart of the earth."

NYCTALOPIA. See MEDICINE, N° 361.

NYCTANTHES, ARABIAN JASMINE: A genus of the monogynia order, belonging to the diandria class of plants; and in the natural method ranking with the 44th order, *Sapiariæ*. The corolla and calyx are octofid; the perianthium dicoccous. There are five species: the most remarkable of which are, 1. The arbor tristis, or sorrowful tree. This tree, or shrub, the *pariatacu* of the Bramins, grows naturally in sandy places in India, particularly in the islands of Ceylon and Java, where it is produced in great abundance, and attains the height of 18 or 20 feet. It rises with a four-cornered stem, bearing leaves that are oval, and taper to a point. They stand opposite, on short footstalks; are of a shining brownish green on the upper side, a more vivid green on the under, and of a taste that is astringent and somewhat bitter. From the middle rib, on the under surface of the leaves, proceed on both sides a number of costulæ, or smaller ribs, which run nearly to the margin, and mark the surface with the impression of their arched furrows. The flowers, which are white and highly odoriferous, having a sweet delectable smell emulating the best honey, consist of one petal deeply divided into eight parts, which are narrower towards the stalk, and dilated towards the summit. They stand upon footstalks, which emerge from the origin of the leaves; are rigid, obliquely raised towards the top, grow opposite in pairs, and are divided into three short lesser branches, which each supports five flowers placed close together, without partial footstalks. The fruit is dry, capsular, membranaceous, and compressed.

It is generally asserted of this plant, that the flowers open in the evening, and fall off the succeeding day. Fabricius and Paludanus, however, restrict the assertion, by affirming, from actual observation, that this effect is found to take place only in such flowers as are immediately under the influence of the solar rays. Grimmius remarks in his *Laboratorium Ceylonicum*, that the flowers of this tree afford a fragrant water, which is cordial, refreshing, and frequently employed with success in inflammations of the eyes. The tube of the [illegible] when dried, has the smell of saffron; and, being pounded and mixed with sanders wood, is used by the natives of the Malabar coast for imparting a grateful fragrancy to their bodies, which they rub or anoint with the mixture.

2. The sambac, noted, like the other species, for the fragrancy of its flowers, is a native likewise of India; and is cultivated in our stoves, where it generally rises with a twining stem to the height of 18 or 20 feet. The leaves are opposite, simple, and entire; but in different parts of the plant assume different forms: the lower leaves being heart-shaped and blunt; the upper, oval and sharp. The flowers are white, inexpressibly fragrant, and generally appear with us in the warm summer months. Strong loam is its proper soil. There is a variety of this species with a double flower, which is much larger and more fragrant than the former.

NYCTASTRATEGI, among the ancients, were officers appointed to prevent fires in the night, or to give alarm and call assistance when a fire broke out. At Rome they had the command of the watch, and were called *nocturni triumviri*, from their office and number.

NYCTICORAX, in ornithology, the night raven; a species of ARDEA.

NYE (Philip), an English nonconformist, a native of Sussex, descended of a genteel family there, was born about 1596. After a proper foundation at the grammar school, he was sent to Oxford, and entered a commoner of Brazen Nose college in 1615, whence he removed in a little time to Magdalen hall, under a puritanical tutor. He took the degrees in arts in 1619 and 1622, about which time he entered into holy orders, and was, some time in 1620, curate of St Michael's church in Cornhill, London. Resolving, however, to reject the constitution of the church of England, he became obnoxious to all the censures of the episcopal court; to avoid which, he went, with others of his persuasion, to Holland, in 1633. He continued for the most part at Arnheim, in Guelderland, till 1640; when, the power of the parliament beginning to prevail over the king, he returned home, and was soon after made minister of Kimbolton in Huntingdonshire, by Edward lord Kimbolton, then earl of Manchester. In 1643, he was appointed one of the

Nye. assembly of divines, and became a great champion of the Presbyterians, and a zealous assertor of the solemn league and covenant; and, having married the daughter of Stephen Marshall, was sent with his father-in-law into Scotland the same year, to expedite the taking of their covenant. Accordingly he harangued that people, in some speeches on the occasion; in which he told them, among other things, that they were entered into such a covenant and league as would never be forgotten by them and their posterity, and both would have occasion to remember it with joy; that it was such an oath, for matter, persons, and other circumstances, that the like had not been in any age, sufficiently warranted both by human and divine story: for, as God did swear for the salvation of men and kingdoms, so kingdoms must now swear for the preservation and salvation of kingdoms, to establish a Saviour Jesus Christ in England, &c. After his return, both houses of parliament took the covenant the same year; at which time he preached a sermon in defence of it, showing its warrant from Scripture, and was rewarded for his good service with the rectory of Acton near London, in the room of Dr Daniel Featly, who was ejected from it. Not long after however, Nye began to dislike the proceedings of the said assembly of divines, and dissented from them, opposing the discipline intended to be settled by them; and, closing with the Independents when they became the reigning faction, he paid his court to the grandees of the army, who often made use of his council. In December 1647 he was sent by them, with Stephen Marshall, to the king at Carisbrook castle, in the isle of Wight, in attendance upon the commissioners then appointed to carry the four dethroning votes, as they are now called, viz. 1. To acknowledge the war raised against him to be just; 2. To abolish episcopacy; 3. To settle the power of the militia in persons nominated by the two houses; 4. To sacrifice all those that had adhered to him: for which service they were rewarded with no less than 500l. a piece. Nye was also employed about that time by the same masters to get subscriptions from the apprentices in London, &c. against a personal treaty with the king, while the citizens of that metropolis were petitioning for one. April the next year he was employed, as well as Marshall and Joseph Caryl, by the Independents, to invite the secured and secluded members to sit in the house again, but without success. In 1653 he was appointed one of the triers for the approbation of public preachers; in which office he not only procured his son to be clerk, but, with the assistance of his father-in-law, obtained for himself a living of 400l. a year. In 1654, he was joined with Dr Lazarus Seaman, Samuel Clark, Richard Vines, Obadiah Sedgwick, Joseph Caryl, &c. as an assistant to the commissioners appointed by parliament to eject such as were then called scandalous and ignorant ministers and schoolmasters in the city of London. After Charles II's restoration in 1660, it was debated by the healing parliament, for several hours together, whether he and John Goodwin should be excepted for life; but the result was, that if Philip Nye, clerk, should after the 1st of September, in the same year 1660, accept or exercise any office, ecclesiastical, civil, or military, he should, to all intents and purposes in law, stand as if he had been totally excepted for life. November 1662 he was vehemently suspected to be engaged in Tongue's plot: but the suspicion was never proved. He died in the parish of St Michael's, Cornhill, London, on Sept. 27. 1672, and was buried in the upper vault of the said church. Wood says he was a dangerous and seditious person, a politic pulpit-driver of independency, an insatiable esurient after riches, and what not, to raise a family, and to heap up wealth.

Nyland, Nyl-Ghau.

NYLAND, a province of Finland in Sweden, lying on the gulf of Finland, to the west of the province of Carelia.

Plate CCCXLVII.

NYL-GHAU, in zoology, of the genus *Bos*, a native of the interior parts of India. "It seems (says Bewick in his Hist. of Quadr.) to be of a middle nature between the cow and the deer, and carries the appearance of both in its form. In size, it is as much smaller than the one, as it is larger than the other; its body, horns, and tail, are not unlike those of a bull; and the head, neck, and legs, are similar to those of a deer. The colour in general is ash or gray, from a mixture of black hairs and white; all along the ridge or edge of the neck, the hair is blacker, longer, and more erect, making a short, thin, and upright mane, reaching down to the hump. Its horns are seven inches long, six inches round at the root, tapering by degrees, and terminating in a blunt point: the ears are large and beautiful, seven inches in length, and spread to a considerable breadth; they are white on the edge and on the inside, except where two black bands mark the hollow of the ear with a zebra-like variety. The height of this animal at the shoulder is four feet one inch; behind the loins, it only measures four feet.

"The female differs considerably from the male both in height and thickness, being much smaller; in shape and colour very much resembling a deer; and has no horns. She has four nipples, and is supposed to go nine months with young. She commonly has one at a birth, but sometimes two.

"Several of this species were brought to this country in the year 1767, which continued to breed annually for some years after. Dr Hunter, who had one of them in his custody for some time, describes it as a harmless and gentle animal; that it seemed pleased with every kind of familiarity, always licked the hand that either stroked or fed it, and never once attempted to use its horns offensively. It seemed to have much dependence on its organs of smell, and snuffed keenly whenever any person came in sight: It did so likewise when food or drink was brought to it; and would not taste the bread which was offered, if the hand that presented it happened to smell of turpentine.

"Its manner of fighting is remarkable, and is described thus. Two of the males at Lord Clive's, being put into an enclosure, were observed, while they were at some distance from each other, to prepare for the attack, by falling down upon their knees; they then shuffled towards each other, keeping still upon their knees; and at the distance of a few yards they made a spring, and darted against each other with great force.

"The following anecdote will serve to show, that during the rutting season these animals are fierce and vicious, and not to be depended upon. A labouring man, without knowing that the animal was near him, went up to the outside of the enclosure; the nyl-ghau, with the

Nymph. the quickness of lightning darted against the wood work with such violence, that he broke it to pieces, and broke off one of his horns close to the root. The death of the animal, which happened soon after, was supposed to be owing to the injury he sustained by the blow.

"Bernier says, that it is the favourite amusement of the Mogul emperor to hunt the nyl-ghau; and that he kills them in great numbers, and distributes quarters of them to his omrahs; which shows that they are esteemed good and delicious food.

"The nyl-ghau is frequently brought from the interior parts of Asia, as a rare and valuable present to the nabobs and other great men at our settlements in India.

"It remains to be considered, whether this rare animal might not be propagated with success in this country. That it will breed here is evident from experience; and if it should prove docile enough to be easily trained to labour, its great swiftness and considerable strength might be applied to the most valuable purposes."

NYMPH, in mythology, an appellation given to certain inferior goddesses, inhabiting the mountains, woods, waters, &c. said to be the daughters of Oceanus and Tethys. All the universe was represented as full of these nymphs, who are distinguished into several ranks or classes. The general division of them is into celestial and terrestrial; the former of them were called *uraniæ*, and were supposed to be intelligences that governed the heavenly bodies or spheres. The terrestrial nymphs, called *epigeiæ*, presided over the several parts of the inferior world; and were divided into those of the water and those of the earth. The nymphs of the water were the *oceanitides*, or nymphs of the ocean; the *nereids*, the nymphs of the sea; the *naiads* and *ephydriades*, the nymphs of the fountains; and the *limniades*, the nymphs of the lakes. The nymphs of the earth were the *oreades*, or nymphs of the mountains; the *napææ*, nymphs of the meadows: and the *dryads* and *hamadryads*, who were nymphs of the forests and groves. Besides these, we meet with nymphs who took their names from particular countries, rivers, &c. as the *cithæroniades*, so called from Mount Cithæron in Bœotia: the *dodonides*, from Dodona; *tiberiades*, from the Tiber, &c.—Goats were sometimes sacrificed to the nymphs; but their constant offerings were milk, oil, honey, and wine.

We have the following account of nymphs in Chandler's Greece. "They were supposed to enjoy longevity, but not to be immortal. They were believed to delight in springs and fountains. They are described as sleepless, and as dreaded by the country people. They were susceptible of passion. The Argonauts, it is related, landing on the shore of the Propontis to dine in their way to Colchos, sent Hylas, a boy, for water, who discovered a lonely fountain, in which the nymphs Eunica, Malis, and Nycheia were preparing to dance; and these seeing him were enamoured, and, seizing him by the hand as he was filling his vase, pulled him in. The deities, their copartners in the cave, are such as presided with them over rural and pastoral affairs.

"The old Athenians were ever ready to cry out, A god! or a goddess! The tyrant Pisistratus entered the city in a chariot with a tall woman dressed in armour resembling Minerva, and regained the Acropolis, which he had been forced to abandon, by this stratagem; the people worshipping, and believing her to be the deity whom she represented. The nymphs, it was the popular persuasion, occasionally appeared; and nympholepsy is characterized as a frenzy, which arose from having beheld them. Superstition disposed the mind to adopt delusion for reality, and gave to a fancied vision the efficacy of full conviction. The foundation was perhaps no more than an indirect, partial, or obscure view of some harmless girl, which had approached the fountain on a like errand with Hylas, or was retiring after she had filled her earthen pitcher.

"Among the sacred caves on record, one on Mount Ida in Crete was the property of Jupiter, and one by Lebadea in Bœotia of Trophonius. Both these were oracular, and the latter bore some resemblance to that we have described. It was formed by art, and the mouth surrounded with a wall. The descent to the landing place was by a slight and narrow ladder, occasionally applied and removed. It was situated on a mountain above a grove, and they related, that a swarm of bees conducted the person by whom it was first discovered. But the common owners of caves were the nymphs, and these were sometimes local. On Cithæron in Bœotia, many of the inhabitants were possessed by nymphs called *Sphragitides*, whose cave, once also oracular, was on a summit of the mountain. Their dwellings had generally a well or spring of water; the former often a collection of moisture condensed or exuding from the roof and sides; and this, in many instances, being pregnant with stony particles, concreted, and marked its passage by incrustation, the ground work in all ages and countries of idle tales framed or adopted by superstitious and credulous people.

"A cave in Paphlagonia was sacred to the nymphs who inhabited the mountains about Heraclea. It was long and wide, and pervaded by cold water, clear as crystal. There also were seen bowls of stone, and nymphs and their webs and distaffs, and curious work, exciting admiration. The poet who has described this grotto, deserves not to be regarded, as servilely copying Homer; he may justly claim to rank as an original topographer.

"The piety of Archidamus furnished a retreat for the nymphs, where they might find shelter and provision, if distressed; whether the sun parched up their trees, or Jupiter enthroned in clouds upon the mountain top scared them with his red lightning and terrible thunder, pouring down a deluge of rain, or brightening the summits with his snow."

Nymph, among naturalists, that state of winged insects between their living in the form of a worm and their appearing in the winged or most perfect state.

The eggs of insects are first hatched into a kind of worms or maggots; which afterwards pass into the nymph state, surrounded with shells or cases of their own skins; so that, in reality, these nymphs are only the embryo insects, wrapped up in this covering; from whence they at last get loose, though not without great difficulty.

During this nymph state the creature loses its motion. Swammerdam calls it *nympha aurelia*, or simply *aurelia*; and others give it the name of *chrysalis*, a term of the like import. See the article Chrysalis.

*Nymph-Bank*, situated about 10 leagues off the coast of the county of Waterford, and province of Munster in

Nymphæ, Nymphæa — in Ireland, is a great fishing place, and 11 leagues S. S. E. from the high head of Dungarvan. It abounds with cod, ling, skate, bream, whiting, and other fish; which was discovered by Mr Doyle, who on July 15. 1736 sailed to it, in company with seven men, on board the Nymph, a small vessel of about 12 guns. This place is well adapted for a fishing company, the great public advantages of which must be very evident.

NYMPHÆ, in anatomy, two membranaceous parts, situated on each side the rima. They are of a red colour, and cavernous structure, somewhat resembling the wattles under a cock's throat. They are sometimes smaller, sometimes larger; and are continuous to the preputium of the clitoris, and joined to the interior side of the labia.

NYMPHÆA, the WATER-[illegible]
monogynia order, belonging to the
plants; and in the natural method
54th order, *Miscellaneæ*. The corolla
the calyx tetraphyllous or pent
multilocular and truncated.
of which the most remarkable
and alba, or yellow and white [illegible] of which are natives of Britain, growing in lakes and ditches. Linnæus tells us, that swine are fond of the leaves and roots of the former; and that the smoke of it will drive away crickets and blattæ, or cockroaches, out of houses.—The root of the second has an astringent and bitter taste, like those of most aquatic plants that run deep into the mud. The Highlanders make a dye with it of a dark chesnut colour. 3. The lotus, with heart-shaped toothed leaves, a plant thought to be peculiar to Egypt, is thus mentioned by Herodotus †: "When the river Nile is become full, and all the grounds round it are a perfect sea, there grows a vast quantity of lilies, which the Egyptians call *lotus*, in the water. After they have cut them, they dry them in the sun, then having parched the seed within the lotus, which is most like the poppy, they make bread of it, baking it with fire. The root also of the lotus is eatable, easily becoming sweet, being round, and of the size of an apple." M. Savary ‡ mentions it as growing in the rivulets and on the sides of the lakes; and that there are two sorts or varieties of the plant, the one with a white, the other with a bluish flower. "The calyx (he says) blows like a large tulip, and diffuses a sweet smell, resembling that of the lily. The first species produces a round root like that of a potato, and the inhabitants of the banks of the lake Menzall feed upon it. The rivulets in the environs of Damietta are covered with this majestic flower, which rises upwards of two feet above the water. 4. In the East and West Indies grows a species of this plant, named *nelumbo* by the inhabitants of Ceylon. The leaves which rest upon the surface of the water are smooth, undivided, perfectly round, thick, target shaped, and about one foot and a half in diameter. The footstalk of the leaves is prickly, and inserted, not into their base, or margin, as in most plants, but in the centre of the lower disk or surface. From this centre, upon the upper surface, issue like rays, a great number of large ribs or nerves, which towards the circumference are divided and subdivided into a small number of very minute parts. The flowers are large, flesh coloured, and consist of numerous petals, disposed, as in the other species of water lily, in two or more rows. The seed vessel is shaped like a top, being broad and circular above, narrow and almost pointed below. It is divided into several distinct cells, which form so many large round holes upon the surface of the fruit; each containing a single seed.—With the flower of this plant, which is sacred among the heathens, they adorn the altars of their temples: they paint their gods sitting upon it; and make use of such pictures to animate the minds of the pious on their deathbed, and to raise their affections to heaven. The stalks, which are used as a pot herb, are of a wonderful length. The root is very long, extends itself transversely, is of the thickness of a man's arm, jointed and fibrous, with long intervals betwixt the joints. The fibres surround the joints in verticilli or whirls. 5 A species of nymphæa, called by the Chinese *lien hoa* and *nenufar*, is highly extolled in that country for its excellent virtues, and ranked by their physicians among those plants which are employed in the composition of *the liquor of immortality*. The seeds are there eaten as we eat filberds in Europe: they are more delicate when they are green, but harder of digestion, they are preserved in many different ways with sugar. The root of this plant is also admitted by the Chinese to their tables: in whatever manner it be prepared, it is equally wholesome. Great quantities of it are pickled with salt and vinegar, which they preserve to eat with their rice. When reduced to powder, it makes excellent soup with water and milk. The leaves of the nenufar are much used for wrapping up fruits, fish, salt provisions, &c. When dry, the Chinese mix them with their smoking tobacco, to render it softer and milder.

† *Euterpe*, c. 92.

‡ *Letters on Egypt*, Vol I.

The high veneration in which the *nymphæa lotos* was held by the Egyptians, is fully known; and at this hour it is equally venerated by the Hindoos. Sir William Jones, in speaking of Brimha, Vishnu, and Shiva, as emblematical representations of the Deity, says,

"The first operations of these three powers are evidently described in the different Puranas by a number of allegories; and from them we may deduce the Ionian philosophy of primæval water, the doctrine of the mundane egg, and the veneration paid to the nymphæa or lotos, which was anciently revered in Egypt, as it is at present in Hindostan, Thibet, and Nepal. The Thibetians are said to embellish their temples and altars with it; and a native of Nepal made prostrations before it on entering my study where the fine plant and beautiful flowers lay for examination."

NYMPHÆA (amongst the ancients), doubtful what structures they were, some take them to have been grottos, deriving their name from the statues of the nymphs with which they were adorned, but that they were considerable works appears from their being executed by the emperors, (Ammian, Victor, Capitolinus) or by the city prefects. In an inscription, the term is written *nymfium*. None of all these nymphæa has lasted down to our time. Some years since, indeed, a square building of marble was discovered between Naples and Vesuvius, with only one entrance, and some steps that went down to it. On the right hand as you

you enter, towards the head, there is a fountain of the purest water; along which, by way of guard as it were, is laid a naked Arethusa of the whitest marble; the bottom or ground is of variegated marble, and encompassed with a canal fed by the water from the fountain: the walls are set round with shells and pebbles of various colours; by the setting of which, as by so many strokes in a picture, are expressed the 12 months of the year, and the four political virtues; also the rape of Proserpine; Pan playing on his reed, and soothing his flock; besides the representations of nymphs swimming, sailing, and wantoning on fishes, &c.

It seems pretty evident that the nymphæa were public baths; for at the same time that they were furnished with pleasing grottos, they were also supplied with cooling streams, by which they were rendered exceedingly delightful, and drew great numbers of people to frequent them. Silence seems to have been a lar requisite there, as appears by this inscription, *Nymphis loci, bibe, lava, tace.* That building between Naples and Vesuvius mentioned above, was certainly one of these nymphæa.

NYMPHÆUM, (Plutarch); the name of a sacred place, near Apollonia in Illyricum, sending forth continually fire in detached streams from a green valley and verdant meadows. Dio Cassius adds, that the fire neither burns up nor parches the earth, but that herbs and trees grow and thrive near it, and therefore the place is called *nymphæum:* near which was an oracle of such a nature, that the fire, to show that the wish was granted, consumed the frankincense thrown into it; but repelled it, in case the desire was rejected. It was there that a sleeping satyr was once caught and brought to Sylla as he returned from the Mithridatic war. This monster had the same features as the poets ascribe to the satyr. He was interrogated by Sylla and by his interpreters; but his articulations were unintelligible, and the Roman spurned from him a creature which seemed to partake of the nature of a beast more than that of a man.

Nymphæum, in antiquity, a public hall magnificently decorated, for entertainments, &c. and where those who wanted convenience at home held their marriage feasts; whence the name.

NYMPHIDIUS (Sabinus), a person of mean descent, but appointed by Nero colleague of Tigellinus in the command of the prætorian guards. About the time, however, that the German legions revolted from this despicable prince, he was also betrayed by Nymphidius and abandoned by his guards.

Nymphidius began now to entertain thoughts of seizing the sovereignty himself. However, he did not immediately declare his ambitious views; but pretending to espouse the cause of Galba, assured the guards that Nero was fled, and promised them such sums as neither Galba nor any other was able to discharge. This promise secured for the present the empire to Galba, occasioned afterwards the loss of it, and, finally, produced the destruction of Nymphidius and the guards themselves. After Nero's death, however, and on the acknowledgment of Galba as emperor, he renewed his ambition; and having, by his immense largesses, gained the affections of the prætorian guards, and persuading himself that Galba, by reason of his infirmities and old age, would never reach the capital, usurped all the authority at Rome. Presuming upon his interest, he obliged Tigellinus, who commanded, jointly with him, the prætorian guards, to resign his commission. He made several magnificent and expensive entertainments, inviting such as had been consuls or had commanded armies, distributed large sums among the people, and with shows and other diversions, which he daily exhibited, gained so great an interest with all ranks, that he already looked upon himself as sovereign. The senate, dreading his power, conferred extraordinary honours upon him, styled him their *protector*, attended him when he appeared in public, and had recourse to him for the confirmation of their decrees, as if he had been already invested with the sovereign power. This base compliance [illegible] to such a degree, that he usurped, not [illegible] by degrees, but all at once, an absolute [illegible]. He acted as sovereign indeed, but he had [illegible] yet openly declared his design of seizing the [illegible] power however was great, and he used [illegible] Galba's power; he was, however, [illegible] the disclosure of his designs was much [illegible]. Galba was again acknowledged and [illegible] and he, notwithstanding his artifices, detected and slain by the soldiers who were proclaiming Galba. See Nero.



NYON, a considerable town of Switzerland, in the canton of Bern, and capital of a bailiwick of the same name, with a castle. It stands delightfully upon the edge of the lake of Geneva, in the very point where it begins to widen, and in a most charming country commonly called *Pays de Vaud*. It was formerly called *Colonia Equestris Noiodunum;* and, as a proof of its antiquity, several Roman inscriptions, and other ancient remains have been frequently discovered in the outskirts of the town. E. Long. 5. 10. N. Lat. 46. 24.

NYSA, or Nyssa (anc. geog.), a town of Ethiopia, at the south of Egypt. Some place it in Arabia. This city, with another of the same name in India, was sacred to the god Bacchus, who was educated there by the nymphs of the place, and who received the name of *Dionysus*, which seems to be compounded of Διος and Νυσα, the name of his father, and that of the place of his education. The god made this place the seat of his empire, and the capital of the conquered nations of the east. According to some geographers, there were no less than ten places of this name. One of these was famous on the coast of Eubœa for its vines, which grew in such an uncommon manner, that if a twig was planted in the ground in the morning, it immediately produced grapes which were full ripe in the evening. A city of Thrace: another seated on the top of Mount Parnassus, and sacred to Bacchus.

NYSLOT, a strong town of Russia, in Livonia, with a castle; seated on the river Narva, among large marshes. E. Long. 26. 55. N. Lat. 58. 46.

NYSSA, in botany: A genus of the order of diœcia, belonging to the polygamia class of plants; and in the natural method ranking under the 12th order, *Holoraceæ*. The hermaphrodite calyx is quinquepartite; there is no corolla; the stamina are five; there is one pistil; the fruit a plum inferior. The male calyx is quinquepartite, no corolla, and ten stamina.

Nyssa.

mina. There is only one species, the *nyssa aquatica* or tupelo tree. It is a deciduous tree or shrub, a native of moist or watery places in America, and consists of two varieties: 1. The entire-leaved; and, 2. The serrated-leaved tupelo.

*Planting and Gardening.*

The entire-leaved tupelo tree, in its native soil and climate, grows to near 20 feet high; in this country its size varies according to the nature of the soil or situation. In a moist rich earth, well sheltered, it comes near to 20 feet; in others, that are less so, it makes slower progress, and in the end is proportionally lower. The branches are not very numerous, and it rises with a regular trunk, at the top of which they generally grow. The leaves are of a lanceolated figure, and of a fine light green colour. They [illegible] points, and are very ornamental, of a thick[illegible]ence, soft, grow alternately on pretty long [illegible] and often retain their verdure late in the [illegible]. The flowers, which are not very ornamental, are produced from the sides of the branches, growing [illegible]ingly, sometimes many together, on a [illegible]. They are of a greenish colour; and, in the co[illegible]here they naturally grow, are succeeded [illegible] enclosing oval, acute, furrowed nuts. [illegible] they seldom produce fruit.

The serrated-leaved tupelo tree grows usually [illegible] 30 feet in height; and divides into branches near the top like the other. The leaves are oblong, pointed, of a light green colour, and come out without order on long footstalks. The flowers come out from the wings of the leaves on long footstalks. They are small, of a greenish colour; and are succeeded by oval drupes, containing sharp-pointed nuts, about the size of a French olive.

The propagation of these trees is from seeds, which come from America. As soon as they arrive, they should be sown in large pots of light sandy earth an inch deep. The gardener (no plants come up the first spring), after this work is done, should plunge his pots up to their rims in the natural ground; and if it be a moist place, it will be the better. Weeding must be observed during the summer; and a few furze-bushes should be pricked round the pots in November, which will prevent the ground from freezing, and forward the coming up of the seeds. In the next spring, the pots should be plunged into an hotbed, and after that the seeds will soon appear. As much air as possible, and watering, should be afforded them; and they must be hardened soon, to be set out. The pots should then be plunged to their rims again in the natural mould; where they are to remain till October. Watering must be given them; and they should also be shaded in the heat of the day. In October, they [illegible] be housed, with other greenhouse plants, or else set under a hot-bed frame, or some other cover, during winter. The third spring they should be taken out of the larger pots, and each planted in a smaller, in which their growth may be assisted by a gentle heat in a bed; but if they are planted up to the rims in a moist place, and shaded in dry weather, they will grow very well. Though by this time they should have become hardy, yet it will be proper to shelter them the winter following in bad weather. They will require little more care during their stay in the pots, which may be either two, three, or more years, if they are large enough; when in spring they may be turned out, with the mould, into the places where they are to remain, which ought always to be moist and properly sheltered.

Nyssa, Nyu-che.

**NYU-CHE**, or Kin, an empire which arose in Eastern Tartary in the beginning of the 13th century. From the founder of this empire the late Chinese emperor Kang-hi said that his family was descended. See China and Tartary.

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# O.

**O**, The 14th letter and fourth vowel of our alphabet; pronounced as in the words *nose*, *rose*, &c.

The sound of this letter is often so soft as to require it double, and that chiefly in the middle of words; as *goose*, *reproof*, &c. And in some words, this *oo* is pronounced like *u* short, as in *flood*, *blood*, &c.

As a numeral, O was sometimes used for 11 among the ancients; and with a dash over it thus, $\bar{O}$, for 11,000.

In the notes of the ancients, O. CON. is read *opus conductum*; O. C. Q. *opera consilioque*; O. D. M. *operæ, donum munus*; and O. L. O. *opus locatum*.

The Greeks had two O's; viz. omicorn, ο, and omega, ω; the first pronounced on the tip of the lips with a sharper sound; the second in the middle of the mouth, with a fuller sound, equal to *oo* in our language. The long and short pronunciation of our O are equivalent to the two Greek ones; the first, as in suppose; the second, as in obey.

O is usually denoted long by a servile *a* subjoined, as *moan*; or by *e* at the end of the syllable, as *bone*; when these vowels are not used, it is generally short.

Among the Irish, the letter O, at the beginning of the name of a family, is a character of dignity annexed to great houses. Thus, in the history of Ireland, we frequently meet with the *O Neals*, *O Carrols*, &c. considerable houses in that island.

Camden observes, that it is the custom of the lords of Ireland to prefix an O to their names to distinguish them from the commonalty.

The ancients used O as a mark of triple time; from a notion that the ternary, or number 3, was the most perfect of numbers, and therefore properly expressed by a circle, the most perfect of figures.

It is not, strictly speaking, the letter O, but the figure

O, Oak.

figure of a circle O, or double CↃ, by which the modern ancients in music used to express what they called *tempo perfetto*, or triple time. Hence the Italians call it *circolo*.

The seven antiphones, or alternate hymns of seven verses, &c. sung by the choir in the time of Advent, were formerly called *O*, from their beginning with such an exclamation.

O is an adverb of calling, or interjection of sorrow or wishing.

OAK, in botany. See QUERCUS.

The oak has been long known by the title of *monarch of the woods*, and very justly. It was well known, and often very elegantly described, by the ancient poets. The following description from Virgil is exquisite:

*Veluti annoso validam cum robore* quercum
*Alpini Boreæ, nunc hinc, nunc flatibus illinc*
*Eruere inter se certant: it stridor, et altæ*
*Consternunt terram concusso stipite frondes:*
*Ipsa hæret scopulis; et quantum vertice ad auras*
*Ætherias, tantum radice in Tartara tendit.*

Æn. iv. 441.

As o'er th' aerial Alps sublimely spread,
Some aged *oak* uprears his reverend head;
This way and that the furious tempests blow,
To lay the monarch of the mountains low;
Th' imperial plant, though nodding at the sound,
Though all his scatter'd honours strew the ground;
Safe in his strength, and seated on the rock,
In naked majesty defies the shock:
High as the head shoots tow'ring to the skies,
So deep the root in hell's foundation lies.

PITT.

The ancient druids had a most profound veneration for oak trees. Pliny † says, that "the druids (as the Gauls call their magicians or wise men) held nothing so sacred as the misletoe, and the tree on which it grows, provided it be an oak. They make choice of oak groves in preference to all others, and perform no rites without oak leaves; so that they seem to have the name of druids from thence, if we derive their name from the Greek," &c. (See DRUIDS—definition, and N° 11.) Maximus Tyrius says the Celtæ or Gauls worshipped Jupiter under the figure of a lofty oak (A).

† Nat. Hist. xvi. c. 44

This useful tree grows to such a surprising magnitude, that were there not many well authenticated instances of them in our own country, they would certainly appear difficult of belief. In the 18th volume of the Gentleman's Magazine we have the dimensions of a leaf twelve inches in length and seven in breadth, and all the leaves of the same tree were equally large. On the estate of Woodhall, purchased in 1775 by Sir Thomas Rumbold, Bart. late governor of Madras, an oak was felled which sold for 43l. and measured 24 feet round. We are also told of one in Millwood forest, near Chaddesley, which was in full verdure in winter, getting its leaves again after the autumn ones fell off. In Hunter's Evelyn's Sylva, we have an account of a very remarkable oak at Greendale; which Gough, in his edition of Camden, thus minutely describes: "The Greendale oak, with a road cut through it, still bears one green branch. Such branches as have been cut or broken off are guarded from wet by lead. The diameter of this tree at the top, whence the branches issue, is 14 feet 2 inches; at the surface of the ground 11¼ feet; circumference there 35 feet; height of the trunk 33, height of the arch 10, width 6. Mr Evelyn mentions several more oaks of extraordinary size in Workfop park."

In the Gentleman's Magazine for 1773 we have an account of one differing very essentially from the common one [illegible] frequent about St Thomas in Devonshire, and is in that county called *Lucombe* oak, from one William Lucombe who successfully cultivated it near Exeter. [illegible] grows as straight and handsome as a fir; its [illegible] evergreen, and its wood as hard as that of [illegible] oak. Its growth is so quick, as to exc[illegible] or 40 years the altitude and girth of the common [illegible] 100. It is cultivated in various places; Cornwall, Somersetshire, &c.

Mr du Hamel du Monceau, of the Royal Academy of Sciences at Paris (who wrote a treatise on husbandry), gave an account in the year 1749 of an oak which he had kept in water eight years, and which yielded fine leaves every spring. The tree had, he says, four or five branches; the largest 19 or 20 lines round, and more than 18 inches long. It throve more in the two first years than it would have done in the best earth; it afterwards lost its vigour, and rather decayed; which he attributed to a defect in the roots rather than to a want of aliment.

M. de Buffon made some experiments on oak trees; the result of which is recorded in the Gentleman's Magazine, 1754. He had compared barked with unbarked trees; and proves, we think with success, from a variety of trials, that timber barked and dried standing, is always heavier and considerably stronger than timber kept in its bark.

The bark of oak trees was formerly thought to be extremely useful in vegetation. One load (Mr Mills in his Treatise on Husbandry informs us) of oak bark, laid in a heap and rotted, after the tanners have used it for dressing of leather, will do more service to stiff cold land, and its effects will last longer, than two loads of the richest dung; but this has been strenuously controverted. (See *Oak Leaves*.)

The bark, in medicine, is also a strong astringent; and hence stands recommended in hæmorrhagies, alvine fluxes, and other preternatural or immoderate secretions; and in these it is sometimes attended with good effects. Some have alleged, that by the use of this bark every purpose can be answered which may be obtained from Peruvian bark. But after several very fair

(A) Camden informs us of a tradition (which, like most other traditions of this nature, seems to be founded in ignorance and fostered by credulity) respecting an oak near Malwood castle, where Rufus was killed, viz. that it budded on Christmas day, and withered before night. This tree, the same tradition reports to have been that against which Tyrrel's arrow glanced.

Oak. fair trials, we have by no means found this to be the case. Besides the bark, the buds, the acorns and their cups are used; as also the galls, which are excrescences caused by insects on the oaks of the eastern countries, of which there are divers sorts; some perfectly round and smooth, some rougher with small protuberances, but all generally having a round hole in them. All the parts of the oak are styptic, binding, and useful in all kinds of fluxes and bleedings, either inward or outward. The bark is frequently used in gargarisms, for the relaxation of the uvula, and for sore mouths and throats: it is also used in restringent clysters and injections, against the pr[illegible] ani. The acorns, beaten to powder, are taken by the vulgar for pains in the side. [illegible] officinal preparation is the aqua gem[illegible]

*Oak Leaves.* The uses of oa[illegible] anning, in hot-beds, is generally known. [illegible] these purposes, however, oak leaves [illegible] answer equally well, or rather better. [illegible] to Dr Hunter's edition of Evelyn's T[illegible] Trees, we find the following directions [illegible] W. Speechly: The leaves are to be [illegible] as possible after they fall from the [illegible] into heaps, they should immediat[illegible] some place near the hot-houses, wher[illegible] couch. Mr Speechly says, it was his custom [illegible] them round with charcoal hurdles, or any thing else, to keep them from being blown about the garden in windy weather. In this place they tread them well, and water them in case they happen to have been brought in dry. The heap is made six or seven feet thick, and covered over with old mats, or any thing else, to prevent the upper leaves from being blown away. In a few days the heap will come to a strong heat. For the first year or two in which he used these leaves, our author did not continue them in the heap longer than ten days or a fortnight: but by this method of management they settled so much when brought to the hot-house, that a supply was very soon required; and he afterwards found, that it was proper to let them remain five or six weeks in the heaps before they are brought to the hot-house. In getting them into the pine pots, if they appear dry, they are to be watered, and again trodden down exceedingly well, in layers, till the pits are quite full. The whole is then covered with tan bark, to the thickness of two inches, and well trodden down, till the surface becomes smooth and even. On this the pine pots are to be placed in the manner they are to stand, beginning with the middle row first, and filling up the spaces between the pots with tan. In this manner we are to proceed to the next row, till the whole be finished; and this operation is performed in the same manner as when tan only is used. The leaves require no farther trouble through the whole season; as they will retain a constant and regular heat for 12 months without stirring or turning; and our author informs us, that if he may judge from their appearance when taken out (being always entire and perfect), it is probable they would continue their heat through a second year; but, as an annual supply of leaves is easily obtained, the experiment is hardly worth making. After this, the pines will have no occasion to be moved but at stated times of their management, viz. at the shifting them in their pots, &c. when at each time a little fresh tan should be added to make up the deficiency arising from the settling of the beds; but this will be inconsiderable, as the leaves do not settle much after their long couching. During the first two years of our author's practice he did not use any tan, but plunged the pine pots into the leaves, and just covered the surface of the beds, when finished, with a little saw-dust, to give it a neatness. This method, however, was attended with one inconvenience; for, by the caking of the leaves they shrunk from the sides of the pots, whereby they became exposed to the air, and at the same time the heat of the beds was permitted to escape.

"Many powerful reasons (says Mr Speechly) may be given why oak leaves are preferable to tanners bark.

"1. They always heat regularly; for during the whole time that I have used them, which is near seven [illegible] I never once knew of their heating with violence; and this is so frequently the case with tan, that I affirm, and indeed it is well known to every person conversant in the management of the hot-house, that pines suffer more from this one circumstance, than all the other accidents put together, insects excepted.—When this accident happens near the time of their fruiting, the effect is soon seen in the fruit, which is exceedingly small and ill-shaped. Sometimes there will be little or no fruit at all; therefore gardeners who make use of tan only for their pines, should be most particularly careful to avoid an over heat at that critical juncture—the time of showing the fruit.

"2. The heat of oak leaves is constant; whereas tanner's bark generally turns cold in a very short time after its furious heat is gone off. This obliges the gardener to give it frequent turnings in order to promote its heating. These frequent turnings, not to mention the expence, are attended with the worst consequences; for by the continual moving of the pots backwards and forwards, the pines are exposed to the extremes of heat and cold, whereby their growth is considerably retarded; whereas, when leaves are used, the pines will have no occasion to be moved but at the times of potting, &c. The pines have one peculiar advantage in this undisturbed situation; their roots grow through the bottoms of the pots, and mat among the leaves in a surprising manner. From the vigour of the plants when in this situation, it is highly probable that the leaves, even in this state, afford them an uncommon and agreeable nourishment.

"3. There is a saving in point of expence; which is no inconsiderable object in places where tan cannot be had but from a great distance.

"4. The last ground of preference is, that decayed leaves make good manure; whereas rotten tan is experimentally found to be of no value. I have often tried it both on sand and clay, and on wet and dry land; and never could discover in any of my experiments, that it deserved the name of a manure; whereas decayed leaves are the richest, and of all others the most proper manure for a garden. Leaves mixed with dung make excellent hot-beds; and I find that beds compounded in this manner, preserve their heat much longer than when made entirely with dung; and

both

both cases, the application of leaves will be a considerable saving of dung, which is a circumstance on many accounts agreeable."

*Oak-Leaf Galls.* These are of several kinds; the remarkable species called the *mushroom gall* is never found on any other vegetable substance but these leaves: and beside this there are a great number of other kinds.

The double gall of these leaves is very singular, because the generality of productions of this kind affect only one side of a leaf or branch, and grow all one way: whereas this kind of gall extends itself both ways, and is seen on each side of the leaf, in form of two protuberances, opposite the one to the other. These are of differently irregular shapes, but their natural figure seems that of two cones, with broad bases, and very obtuse points, though sometimes they are round, or very nearly so.

These make their first appearance on the leaf in April, and remain on it till June or longer. They are at first green, but afterwards yellowish, and are softer to the touch than many other of the productions of this kind: they are usually about the size of a large pea, but sometimes they grow to the bigness of a nut. When opened, they are found to be of that kind which are inhabited each by one insect only, and each contains one cavity. The cavity in this is, however, larger than in any other gall of the size, or even in many others of three times the size; the sides of it being very little thicker than the substance of the leaf.

It is not easy to ascertain the origin of the several species of flies which are at times seen in this manner to come out of the same species of galls. It seems the common course of nature, that only one species of insect forms one kind of gall; yet it may be, that two or three kinds may give origin to the same kind. There is, however, another occasion of our seeing different species come out of different galls of the same kind: and this is the effect of the enemies of the proper inhabitants.

It might appear that the parent fly, when she had formed a gall for the habitation of her worm offspring, had placed it in an impregnable fortress; but this is not the case; for it frequently happens, that a fly, as small perhaps as that which gave origin to the gall, produces a worm which is of the carnivorous kind, as the other feeds on vegetable juices. This little fly, well knowing that where there is one of these protuberances on a leaf, there is a tender and defenceless insect within, pierces the sides of the gall, and deposites her egg within it. This, when it hatches into a worm, feeds upon the proper inhabitant; and finally, after devouring it, passes into the chrysalis state, and thence appears in the form of its parent fly, and is seen making its way out of the gall, in the place of the proper inhabitant.

On opening these leaf-galls, which are properly the habitation only of one animal, it is common to find two, the stronger preying upon the body of the other, and sucking its juices as it does those of the leaf: often it is found wholly employed in devouring its unoffending neighbour at once: this is probably the case when its time of eating is nearly over; and, in fine, when we find the gall inhabited by only one insect, or containing only one chrysalis, as it ought in its natural state to do, we are never certain that this is the proper inhabitant, as it may be one of these destroyers who has eaten up the other, and supplied its place. See APHIS and *Oak* PUCERON.



*Oak Saw-dust* is now found to answer the purposes of tanning, as well, at least, as the bark. See TANNING.

*Oak of Jerusalem.* See CHENOPODIUM.

OAKHAM, OCKHAM, or *Oakum*, in sea-language, denotes the matter of old ropes untwisted and pulled out into loose hemp, in order to be used in caulking the seams, tree-nails, and bends of a ship, for stopping or preventing leaks.

OAKHAMPTON, a town of Devonshire, which sends two members to parliament; situated in W. Long. 4. 5. N. Lat. 50. [illegible]

OANNES, a being in Chaldean mythology, represented as half a man and half a fish. According to Berosus and other fabulous writers, this monster was the civilizer of the Chaldeans; to whom he taught a system of jurisprudence so perfect as to be incapable of improvement. In discharging the duties of his office, he spent the day on dry land, but retired every night into the ocean or the river. See MYTHOLOGY, N° [illegible]

OAR, a long piece of timber, flat at one end and round or square at the other; and which being applied to the side of a floating vessel, serves to make it advance upon the water.

That part of the oar which is out of the vessel, and which enters into the water, is called the *blade*, or *wash-plat*; and that which is within board is termed the *loom*, whose extremity being small enough to be grasped by the rowers, or persons managing the oars, is called the *handle*.

To push the boat or vessel forwards by means of this instrument, the rowers turn their backs forward, and, dipping the blade of the oar in the water, pull the handle forward so that the blade at the same time may move aft in the water: but since the blade cannot be so moved, without striking the water, this impulsion is the same as if the water were to strike the blade from the stern towards the head: the vessel is therefore necessarily moved according to this direction. Hence it follows, that she will advance with the greater rapidity, by as much as the oar strikes the water more forcibly. Thus it is evident, that an oar acts upon the side of a boat or vessel like a lever of the second class, whose fulcrum is the station upon which the oar rests on the boat's gunnel. In large vessels, this station is usually called the *row-port*; but in lights and boats it is always termed the *row-lock*.

OARISTUS, or OARISTYS, a term in the Greek poetry, signifying a dialogue between a husband and his wife; such as that in the sixth book of the Iliad between Hector and Andromache.

Scaliger observes, that the oaristus is not properly any particular little poem, or entire piece of poetry; but always a part of a great one. He adds, that the passage now cited in Homer is the only proper oaristus extant in the ancient poets.

OAT, in botany. See AVENA.

Under the word AVENA it was observed, that the native place of the common oat, cultivated in our fields,

is unknown; that the only account of it, in its natural state, which we then had, is in Anfon's Voyage; and that the report of fuch an author refpecting facts in natural hiftory is not entitled to implicit credit. We had not then feen the Travels of Mr Bruce, whofe botanical knowledge is very fuperior to that of moft voyagers, or we fhould have mentioned his account of the oats which he found growing wild in Arooffi, a fmall territory in Abyffinia, not far from the fource of the Nile: (See NILE). "Wild oats (fays he) grow up here fpontaneoufly to a prodigious height and fize, capable often of concealing both the horfe and his rider, and fome of the ftalks being little lefs than an inch in circumference. They have, when ripe, the appearance of fmall canes. The inhabitants make no fort of ufe of this grain in any period of its growth: the uppermoft thin hufk of it is [illegible] variegated with a changeable purple colour; th[illegible] perfectly good. I often made the meal into [illegible] remembrance of Scotland." Our author [illegible] the Abyffinians could never be brought [illegible] thefe cakes, which they faid were bitter, [illegible] ftomachs, and made them thirfty. He [illegible] decidedly of opinion, that the wild oat [illegible] the oat in its original ftate; and that it [illegible] everywhere in Europe. From the [illegible] ftates, this opinion feems to be well founded.

OATH, an affirmation or promife, accompanied with an invocation of God to witnefs what we fay; and with an imprecation of his vengeance, or a renunciation of his favour, if what we affirm be falfe, or what we promife be not performed (A).

The laws of all civilized ftates have required the fecurity of an oath for evidence given in a court of juftice, and on other occafions of high importance (B); and the Chriftian religion utterly prohibits fwearing, except when oaths are required by legal authority. Indeed no ferious and reflecting theift, whether he admit the truth of revelation or not, can look upon fwearing on trivial occafions as any thing elfe than a fin of a very heinous nature. To call upon that infinite and omniprefent Being, who created and fuftains the univerfe, to witnefs all the impertinence of idle converfation, of which great part is commonly uttered at *random*, betrays a fpirit fo profane, that nothing fhort of experience could make us believe it poffible for a creature endowed with reafon and reflection to be habitually guilty of a practice fo impious. No man can plead in extenuation of this crime, that he is tempted to fwear by the importunity of any appetite or paffion implanted in the human breaft: for the utterance of a profane oath communicates no pleafure, and removes no uneafinefs: it neither elevates the fpeaker, nor depreffes the hearer.

*Quakers* and *Moravians*, fwayed by thefe confiderations, and by the fenfe which they put upon certain texts of Scripture, refufe to fwear upon any occafion, even at the requifition of a magiftrate, and in a court of juftice. Thefe fcruples are groundlefs; and feem to proceed from an incapacity to diftinguifh between the proper ufe and abufe of fwearing. It is unqueftionably impious to call upon God to witnefs impertinences, or to ufe his tremendous name as a mere *expletive* in converfation; but it by no means follows, that we may not pioufly call upon him to witnefs truths of importance, or invoke his name with reverence and folemnity. No individual could, without grofs profanenefs, pray for a thoufand times more wealth than he may ever have occafion to ufe; but it is never thought profane to pray "day by day for [illegible] daily bread, for rain from heaven, and fruitful fea[illegible] If it be lawful to afk of God thefe earthly [illegible] becaufe he alone can beftow them; it cannot furely be unlawful, where the lives or properties of our neighbours, or the fecurity of government is concerned, to invoke him with reverence to witnefs the truth of our affertions, or the fincerity of our intentions; becaufe of our truth in many cafes, and of our fincerity in all, none but he can be the witnefs.

The text of Scripture upon which the Quakers chiefly reft their argument for the unlawfulnefs of all fwearing under the Gofpel, is our Saviour's prohibition



(A) The word *oath* is a corruption of the Saxon *eoth*. It is often in England called a *corporal oath*, becaufe, in the days of popery, the perfon was fworn over the hoft or *corpus Chrifti*.

(B) The various oaths required by different nations at different times, and the various forms, &c. of impofing them, is a fubject of very confiderable extent and curiofity: An account of them does not fall within the [illegible] of the prefent article; it would indeed extend it to an undue length: we cannot, however, omit obferving, what is doubtlefs very remarkable, that the grand impoftor Mahomet taught the Moflems, that their oaths might be diffolved. This wonderful doctrine is contained in the 66th chapter of the Koran; which, to free himfelf from his promife and oath to Hafsa his fpoufe, he pretended was revealed. What the ufe of oaths is in fuch circumftances, or what fecurity they afford for performance, it is difficult to afcertain.

It is alfo very remarkable, that an oath refpecting marriages was the caufe of the firft divorce at Rome. The circumftance happened about the year of the city 525, Pofthumius Albinus and Spurius Carvilius being confuls. The cenfors of this year obferving the population declining, and imagining it proceeded from interefted marriages and promifcuous cohabitation, obliged all the citizens to fwear, that they would not marry with any other view than that of peopling the republic. It raifed, however, many fcruples, and occafioned many domeftic ruptures. Among the reft, one Carvilius Ruga, a man of diftinction, imagined that he was bound by his oath to divorce his wife, whom he paffionately loved, becaufe fhe was barren, which was the firft inftance of a divorce at Rome from its foundation, though the marriage laws of the kings allowed [illegible]; it afterwards, however, became fhamefully frequent. This is alfo a ftriking inftance of the great attention paid to oaths among the Romans: it is remarked indeed by all writers, that they paid a moft profound refpect to them; and on that we know they founded their hopes of fuccefs in war.

Oath.

tion (Mat. v. 34.): "I say into you, swear not at all." But whoever shall take the trouble of turning over his Bible, and looking at the context, will perceive, that it is only in *ordinary conversation*, and by no means in courts of justice, that our Lord prohibits his followers from swearing at all. There is no evidence whatever, that swearing by *heaven*, by *the earth*, by *Jerusalem*, or by their own *heads*, was the form of a *judicial oath* in use among the Jews. On the contrary, we are told by *Maimonides**, that "if any man swear by heaven or by earth, yet this is not an oath;" which surely he could not have said, had such been the forms of judicial swearing. Indeed they could not have admitted such forms into their courts without expressly violating the law of Moses, who commands them to "Fear the Lord (JEHOVAH) their God, to serve him, and to swear by his NAME." But the Jews, as every one knows, had such a reverence for the name *Jehovah*, that they would not pronounce it on slight occasions, and therefore could not swear by that name in common conversation. Hence, to gratify their propensity to common swearing, they invented such oaths as, by *heaven*, by *earth*, by *Jerusalem*, by *the life of thy head*, &c. and by this contrivance they thought to avoid the guilt of profaning the name JEHOVAH. These, however, being appeals to insensible objects, either had no meaning, or were in fact, as our Saviour justly argues, oaths by that God whose creatures they were; so that the Jew who swore themselves was still guilty of profaneness towards the very JEHOVAH whose name his superstition would not permit him to pronounce. But what puts it beyond all doubt that the use of judicial oaths is not wholly prohibited in the gospel, is the conduct of our Saviour himself as well as of his apostle St Paul. When Jesus was simply *asked* by the high priest, what it was which certain false witnesses testified against him? we are told by the evangelists, that "he held his peace:" but being *adjured* by the living God to declare whether he was the Christ, the Son of God, or not, he immediately answered the high priest, without objecting to the *oath* (for such it was) upon which he was examined. "St Paul, in his Epistle to the Romans†, says, '*God is my witness*, that, without ceasing, I make mention of you in my prayers;' and to the Corinthians, still more strongly, '*I call God for a record upon my soul*, that, to spare you, I came not as yet to *Corinth*.' Both these expressions are of the nature of oaths; and the author of the Epistle to the Hebrews speaks of the custom of swearing judicially without any mark of censure or disapprobation; 'Men verily swear by the greater; and an oath, for confirmation, is to them an end of all strife."

* See *Whitby on the Place.*

† *Paley's Moral Philosophy.*

But though a nation has an undoubted right to require the security of an oath upon occasions of r importance, we do not hesitate to say, that, in our opinion, it is something worse than bad policy to multiply oaths, and to hold out to the people temptations to perjure themselves. The security which an oath affords, depends entirely upon the reverence which attaches to it in the mind of him by whom it is given; but that reverence is much weakened by the frequency of oaths, and by the careless manner in which they are too often administered. An excellent moralist ‡ observes, with truth, that "the levity and frequency with which oaths are administered, has brought about a general inadvertency to the obligation of them, which both in a religious and political view is much to be lamented; and it merits (continues he) public consideration, whether the requiring of oaths on so many frivolous occasions, especially in the customs, and in the qualification for petty offices, has any other effect than to make them cheap in the minds of the people. A pound of tea cannot travel regularly from the ship to the consumer without costing *half a dozen oaths* at least; and the same security for the due discharge of his office, namely that of an oath, is required from a *church warden* and an *archbishop*, from a *petty constable* and the *chief justice* of England. Let the law continue its own sanctions, if they be thought requisite; but let it spare the solemnity of an oath. And where it is necessary, from the want of something better to depend upon, to accept a man's own word or own account, let it annex to prevarication penalties proportioned to the public consequence of the offence."

‡ *Mr Paley.*

"That these pernicious consequences of frequent oaths are not felt only in England, we have the evidence of another respectable writer, whose acuteness well qualified him to observe, whilst his station in society furnished him with the best opportunities of observing, the effects of repeated swearing upon the morals of Scotchmen. "Customhouse oaths (says Lord Kames*) have become so familiar among us, as to be swallowed without a wry face; and it is certain that bribery and perjury in electing parliment members are not approaching to the same cool state? Men creep on to vice by degrees. Perjury, in order to support a friend, has become customary of late years; witness fictitious qualifications in the electors of parliament-men, which are made effectual by perjury: yet such is the degeneracy of the present times (c), that no man is the worse thought of upon that account. We must not flatter ourselves, that the poison will reach no farther: a man who boggles not at perjury to serve a friend, will in time become such an adept, as to commit perjury in order to ruin a friend when he becomes an enemy."

* *Sketches of the History of Man.*

Besides the frequency of oaths, we have mentioned the irreverent manner in which they are too often administered as one of the causes which make them cheap in the estimation of the people. In this view, the *form* of the oath, and the *ceremonies* with which it is required to be taken, are of considerable importance.

"The

(c) Such was the case when his Lordship wrote. Some decisions of the house of peers, however, have since that period changed men's opinions respecting the legality of these votes and the innocence of the means by which they were made effectual. It is to be hoped that such a reformation will soon be made of the laws by which elections are regulated in Scotland, as will render the temptations to perjury less numerous than they have hitherto been.

Oath.

"The forms of oaths in Christian countries (says Mr Paley) are very different; but in none I believe worse contrived either to convey the meaning or to impress the obligation of an oath, than in England. In that country the juror, after repeating the promise or affirmation which the oath is intended to confirm, adds, 'so help me God;' or more frequently the substance of the oath is repeated to the juror by the officer or magistrate who administers it; adding in the conclusion, 'so help you God.' The energy of the sentence resides in the particle *so*; *so*, i. e. *hac lege*, 'upon condition of my speaking the truth, or performing this promise, may God help me, and not otherwise.' The juror, whilst he hears or repeats the words of the oath, holds his right hand upon a Bible, or other book containing the four gospels. The conclusion of the oath sometimes runs, '*ita me Deus adjuvet, et hac sancta evangelia*,' or 'so help me God, and the contents of this book;' which last clause forms a connexion between the words and action of the juror, which before was wanting. The juror then kisses the book."

This obscure and elliptical form, [illegible] author justly observes, is ill calculat[illegible] the juror with reverence: and he seems [illegible] great preference due to the form of judicial oaths in Scotland. In that country the juror holds [illegible] hand towards heaven, and swears by Almighty God, and as he shall answer to God at the great day of judgment, "that he will tell the truth, the whole truth, and nothing but the truth, so far as he knows, or it shall be asked of him." This, if administered with dignity and reverence, is an oath sufficiently solemn and well calculated to have the proper effect upon the mind of the juror, as it brings immediately into his view the Author of his being, and the awful day of final retribution when every man shall receive the things done in his body according to that he hath done, whether it be good or evil. But when the magistrate, as is too often the case, repeats this solemn invocation without rising from his seat at the name of the supreme Being, and in a tone of carelessness which may convey to the ignorant juror an opinion that he has himself no serious belief that there ever will be a great day of judgment, the form, however excellent, makes not its full impression.

But let us suppose the oath to be administered with the greatest dignity and reverence, the words of the promise itself appear to us by no means unexceptionable. In a trial on life and death, we should be glad to know wh[illegible] this oath binds the witness to declare. Is he to tell *all that he knows* touching the matter in question? or only all that shall be *asked* of him? If he be obliged, in virtue of his oath, to tell all that he knows, the clause—"or it shall be asked of you" is superfluous, and calculated to mislead. If he be bound to tell nothing more of the truth than what shall be asked of him, the word *or* should be changed into *and*; he should swear "to tell the truth, &c. so far as he knows, *and* it shall be asked of him." The court, we believe, considers the witness as bound to declare every thing which he knows touching the matter in question. The greater part of witnesses, on the other hand, consider themselves as bound no farther by their oath than to give true answers to such questions as shall be asked of them. They would do well, however, to remember, that as oaths are designed for the security of the *public*, they must be interpreted in the sense in which the public intends them, otherwise they afford no security. But the sense of the public is the law; and as it belongs to the court to declare what the mind of the law is, the witness, who has any doubt concerning the extent of the obligation imposed on him by the words of this oath, should apply to the court for a solution of that doubt, which will be a safe guide to him respecting the evidence which he is to give. Should the court, in resolving the doubts of a witness, give an opinion concerning the sense of any other part of the oath contrary to what he apprehends to be the design of the law in imposing it, he is bound to disregard such opinion; because it is only when [illegible] himself is doubtful that the court has a right to [illegible]re, and because in all moral questions men must [illegible]ally determined by their own judgment and conscience.

There is one case, and but one, in which, whatever sense be put upon the words of the oath, no witness is obliged to declare the *whole* truth. It is when such declaration would tend to accuse himself of some legal crime; for as the laws of Scotland and England constrain no man to become his own accuser, they must be considered as imposing the oath of testimony with this tacit reservation. "The exception, however †, must be confined to *legal* crimes. A point [illegible]nour, of delicacy, or of reputation, may make a witness backward to disclose some circumstance with which he is acquainted; but is no excuse for concealment, unless it could be shown, that the law which imposes the oath, intended to allow this indulgence to such motives. The exception is also withdrawn by compact between the magistrate and the witness, when an accomplice is admitted to give evidence against the partners of his crime." But these are a sort of witnesses to whom a sensible jury will always listen with a very cautious ear.

† Paley's Moral Philosophy.

Oaths are either *assertory* or *promissory*. Assertory oaths are required both to confirm our veracity in evidence, and to give security to the public that we *believe* certain propositions conceived to be of public importance. An oath in *evidence* binds the juror to declare what he *knows* to be true, and nothing *but* what he knows to be true. An oath required to assure the public of our *belief* in the *truth* of any proposition, cannot, without the guilt of perjury, be taken by any man, who, at the time of swearing, has the slightest doubt whether the proposition be really true. Such an oath, however, though it unquestionably requires the sincerity of the juror's belief at the time when it is given cannot oblige him to continue in that belief as long as he may live; for belief is not in any man's power: it is the necessary consequence of evidence, which *compels* the assent of the mind according as it appears to preponderate on the one side or on the other. No man, therefore, can be justly accused of perjury for holding opinions contrary to those which he may formerly have sworn to believe; because his belief at the time of emitting his oath may have been the necessary result of the evidence which then appeared before him; and his change of opinion may have resulted with the same necessity from superior



evidence

evidence which had been since thrown into the opposite scale, and made it preponderate. On this account, we cannot help thinking, that all assertory oaths, except such as are necessary to confirm testimony respecting *facts*, ought either to be abolished or expressed with great caution. Of truths intuitively certain or capable of rigid demonstration, no man of common sense can entertain a doubt; and therefore the public never requires from individuals the solemnity of an oath as an assurance of their believing such truths. But with respect to the truth of propositions which admit of nothing superior to moral evidence on either side, a man of the most steady virtue may think differently at different periods of his life; and in such cases, the effect of an oath, if it have any effect, can only be either to shut the man's eyes against the light, or to [illegible] integrity be causelessly questioned by those who shall observe his change of belief.

Promissory oaths cannot, without the guilt of perjury, be given by him, who, at the time of swearing, knows that it will not be in his power to fulfil the promise, or who does not seriously intend to fulfil it. A promissory oath cannot, without great guilt, be given by any man, who at the time of swearing believes the object of the promise to be in itself unlawful; for if he seriously mean to fulfil his oath, he calls upon Almighty God to witness his intention to commit a crime. Promissory oaths give to the public greater security than a simple promise; because the juror having the thoughts of God and of religion more upon his mind at the one time than at the other, offends with a higher hand, and in more open contempt of the divine power, knowledge, and justice, when he violates an oath, than when he breaks a promise. Yet it is certain that promissory oaths, though more solemn and sacred, cannot be binding, when the promise without an oath would not be so in an inferior degree; for the several cases of which, see PROMISE and ALLEGIANCE.

*Coronation OATH.* See KING.

OATHLAW, the name of a parish in Angus, about two miles from Forfar, chiefly remarkable for the remains of a Roman camp called *Battle-dykes* (vulgarly *Black-dykes*), which is about a mile west of the church.

OBADIAH, or the *Prophecy of* OBADIAH, a canonical book of the Old Testament, which is contained in one single chapter; and is partly an invective against the cruelty of the Edomites, who mocked and derided the children of Israel as they passed into captivity; and with other enemies, their confederates, invaded and oppressed those strangers, and divided the spoil among themselves; and partly a prediction of the [illegible] of Israel, and of the victory and triumph of the [illegible] church over her enemies.

OBADIAH, the prophet, is believed to have been the same with the governor of Ahab's house, mentioned in the first book of Kings, (xviii. 3, &c.) who hid and fed the hundred prophets whom Jezebel would have destroyed; and some say, that he was that Obadiah whom Josiah made overseer of the works of the temple, (2 Chron. xxxiv. 12.) The truth is, that when he lived or prophesied is wholly uncertain: though most writers make him cotemporary with Hosea, Amos, and Joel.

OBADIAH, a valiant man of David's army, who came to join him in the wilderness, with several others of the tribe of Gad, (1 Chron. xii. 9.)

This was also the name of one of those whom King Jehoshaphat sent into the cities of Judah to instruct the people in their religion, (2 Chron. xvii. 7.) It was also the name of one of the principal men of Judah, who signed the covenant that Nehemiah renewed with the Lord, (Nehem. x. 5.)

OBED-EDOM, son of Jeduthun, a Levite, (1 Chr. xvi. 38.) and father of Shemaiah, Jehozabad, Joah, Sacar, Nathaneel, Ammiel, Issachar, and Peulthai. He had a numerous family, says the Scripture, (1 Chr. xxvi. 4.) because the Lord blessed him; and this is the occasion of the blessing. When David transferred the ark of the covenant to the city of Jerusalem, Uzzah having rashly laid hands on the ark, which he thought to be in danger of falling, was smitten of God, and died upon the spot. David, terrified at this [illegible] remove the ark into the place he [illegible] in his own house, but set it up in [illegible] edom, which was near the place [illegible] been struck dead. But the presence [illegible] only created no temporal misfortune to [illegible] of this Levite, but on the contrary the [illegible] d upon him all sorts of blessings; which [illegible] ed David some months after to remove it to the place he had appointed for it. Afterwards Obed-edom and his sons were assigned to be keepers of the doors of the temple, (1 Chron. xv. 18, 21.) In the second book of Samuel, (vi. 10.) Obed-edom is called the Gittite, probably because he was of Gathrimmon, a city of the Levites beyond Jordan, (Josh. xxi. 24, 25.)

OBELISK, in architecture, a truncated, quadrangular, and slender pyramid, raised as an ornament, and frequently charged either with inscriptions or hieroglyphics.

Obelisks appear to be of very great antiquity, and to have been first raised to transmit to posterity precepts of philosophy, which were cut in hieroglyphical characters: afterwards they were used to immortalize the great actions of heroes, and the memory of persons beloved. The first obelisk mentioned in history was that of Ramases king of Egypt, in the time of the Trojan war, which was 40 cubits high. Phius, another king of Egypt, raised [illegible] of 55 cubits; and Ptolemy Philadelphus, another [illegible] 88 cubits, in [illegible] noë. Augustus erected [illegible] at Rome in the [illegible] which served to [illegible] the hours on a horizontal dial, drawn on the [illegible]. They were called by the [illegible] s *of the sun*, because they [illegible] as styles or gnomons [illegible] still call them *Pharaoh's needles*; whence the [illegible] them *eguglia*, and the French *aiguilles*.

The famous obelisks called the *devil's arrows*, now reduced to three, the fourth having been taken down in the last century, stand about half a mile from the town of Borough-Bridge to the south-west, in three fields, separated by a lane, 200 feet asunder, nearly on high ground sloping every way. Mr Drake urges many

many arguments for their Roman antiquity, and plainly proves them to be natural and brought from Hampton quarries about five miles off, or from Ickly 16 miles off. The cross in the town, 12 feet high, is of the same kind of stone. The eastermost or highest is 22 feet and a half high by 4 broad, and 14½ in girth; the second 21½ by 55½; the third 16½ by 84. Stukeley's measures differ. The flutings are cut in the stone but not through: the tallest stands alone, and leans to the south. Plot and Stukeley affirm them to be British monuments, originally hewn square. Dr Gale supposed that they were Mercuries, which have lost their heads and inscriptions; but in a MS note in his Antoninus, he acknowledges that he was misinformed and that there was no cavity to receive a bust.

On the north side of Penrith, in the churchyard, are two square obelisks, of a single stone each, 11 or 12 feet high, about 12 inches diameter, and 12 by 8 at the sides, the highest about 18 inches diameter, with something like a transverse piece [illegible] into a round base. They are 14 [illegible] tween them is a grave enclosed [illegible] semicircular stones of the unequal length [illegible], and four and a half, and two feet high [illegible] on the outsides rude carving, and the tops notched. This is called the *Giant's grave*, and ascribed to Sir Ewan Cesarius, who is said to have been as tall as one of the columns, and capable of stretching his arms from one to the other; to have destroyed robbers, and wild boars in Englewood forest; and to have had an hermitage hereabouts called *Sir Hugh's parlour*; but the conjectures respecting them are so various and contradictory, that our readers will readily excuse our enlarging on them.

A little to the west of these is a stone called the *Giant's Thumb*, six feet high, 14 inches at the base contracted to 10, which is no more than a rude cross, such as is at Langtown in Cumberland and elsewhere; the circle of the cross 18 inches diameter.

M. Pouchard, in the memoirs of the Academy of Inscriptions, gives a very curious account of some celebrated Egyptian obelisks. We cannot afford room to follow him; but those who wish for further information on the subject, and who are not possessed of the original, will find a very good account of them in the Gentleman's Magazine for June 1748.

OBJECT, in philosophy, something apprehended or presented to the mind by sensation or imagination. See METAPHYSICS, Part I. Chap. I. Sect. II.

OBJECT-*Glass* of a *Telescope*, or *Microscope*, the glass placed at [illegible] the tube which is next the object. See OPTICS and MICROSCOPE.

OBJECTION, something urged to overthrow a position, or a difficulty raised against an allegation or proposition of a person we are disputing with.

OBJECTIVE, is used in the schools, in speaking of a thing which exists no otherwise than as an object known. The existence of such a thing is said to be objective.

OBIT, (Lat.) signifies a funeral solemnity, or office for the dead, most commonly performed when the corpse lies in the church uninterred: Also the anniversary office. (2 Cro. 51 Dyer 313). The anniversary of any person's death was called the *obit*; and to observe such day with prayers and alms, or other commemoration, was the keeping of the obit. In religious houses they had a register, wherein they entered the obits or obitual days of their founders and benefactors; which was thence termed the *obituary*. The tenure of obit or chantry lands is taken away and extinct by 1 Edward VI. c. 14. and 15 Car. II. c. 9.

OBLATI, in church history, were secular persons, who devoted themselves and their estates to some monastery, into which they were admitted as a kind of lay brothers. The form of their admission was putting the bell ropes of the church round their necks, as a mark of servitude. They wore a religious habit, but different from that of the monks.

OBLIGATION, in general, denotes any act whereby a person becomes bound to another to do something; as to pay a sum of money, be surety, or the like.

Obligations are of three kinds, *viz.* natural, civil, and mixed. Natural obligations are entirely founded on natural equity; civil obligation on civil authority alone, without any foundation in natural equity; and mixed obligations are those which, being founded on natural equity, are farther enforced by civil authority.

In a legal sense, obligation signifies a bond, wherein is contained a penalty, with a condition annexed for the payment of money, &c. The difference between it and a bill is, that the latter is generally without a penalty or condition, though it may be made obligatory. And obligations are sometimes by matter of record, as statutes and recognizances. See the article BOND.

*Moral Obligation.* See MORAL PHILOSOPHY, N° 58, &c.

OBLIQUE, in geometry, something aslant, or that deviates from the perpendicular. Thus an oblique angle is either an acute or obtuse one, *i. e.* any angle except a right one.

*Oblique Cases*, in grammar, are all the cases except the nominative. See GRAMMAR.

*Oblique Line*, that which, falling on another line, makes oblique angles with it, *viz.* one acute and the other obtuse.

*Oblique Planes*, in dialling, are those which decline from the zenith, or incline towards the horizon. See DIAL.

*Oblique Sailing*, in navigation, is when a ship sails upon some rhumb between the four cardinal points, making an oblique angle with the meridian; in which case she continually changes both latitude and longitude. See NAVIGATION, Chap. VIII.

OBLIQUUS, in anatomy, a name given to several muscles, particularly in the head, eyes, and abdomen, See ANATOMY, *Table of the Muscles*.

OBLONG, in general, denotes a figure that is longer than broad; such is a parallelogram.

OBOLARIA, in botany: A genus of the angiospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 40th order, *Personatæ*. The calyx is bifid; the corolla campanulated and quadrifid; the capsule unilocular, bivalved, and polyspermous; the stamina rising from the divisions of the corolla.

OBOLUS, an ancient silver money of Athens, the sixth part of a drachma; worth somewhat more than a penny

Obolus ‖ Observatory.

penny-farthing sterling.—The word comes from the Greek ὀϐολος, or ὀϐελος, "spit, or broach;" either because it bore such an impression; or because, according to Eustathius, it was in form thereof. But those now in the cabinets of the antiquaries are round.

Obolus, in medicine, is used for a weight of ten grains, or half a scruple.

OBOTH, an encampment of the Hebrews in the wilderness. From Punon they went to Oboth, and from Oboth to Ije-abarim, (Numb. xxi. 10. xxxiii. 43.) Ptolemy speaks of a city called Oboda, or Eboda, in Arabia Petræa, which is the same as Oboth. Pliny and the geographer Stephanus mention it also. Stephanus makes it belong to the Nabathæans, and Pliny to the Helmodeans, a people of Arabia. It was at Oboth that they worshipped the god Obodos, which Tertullian joins with Dusares, another god or king of this country.

OBRECHT (Ulric), a learned German, born of a noble family at Strasburg in 1646, where he filled the chairs of civil law and history with great distinction. He was of the Protestant religion; but when Louis XIV. made himself master of Strasburg, and went there with his court, he was prevailed on to change; and accordingly abjured in 1684, and put his instrument into the hands of Bossuet bishop of Meaux. The next year the king nominated him to preside in his name in the senate of Strasburg, with the title of prætor royal, in imitation of the ancient Romans; from which time Mr Obrecht applied himself entirely to public affairs. He was the editor, translator, and writer, of several learned works; and died in 1701.

OBREPTITIOUS, an appellation given to letters patent, or other instruments, obtained of a superior by surprise, or by concealing from him the truth.

OBSCURE, something that is dark and reflects little light in material objects, or that is not clear and intelligible in the objects of the intellect.

OBSECRATION, in rhetoric, a figure whereby the orator implores the assistance of God or man.

OBSEQUENS (Julius), a Latin writer, conjectured to have lived before the emperor Honorius's reign. He made a collection of the prodigies which Livy related in his history. There are several editions of those remains. Lycosthenes endeavoured to supply what was wanting in the original.

OBSEQUIES, the same with funeral solemnities. See Funeral.

OBSERVATION, among navigators, signifies the taking the sun's or the stars meridian altitude, in order thereby to find the latitude.

OBSERVATORY, a place destined for observing the heavenly bodies; being generally a building erected on some eminence, covered with a terrace for making astronomical observations.

The more celebrated observatories are, 1. The Greenwich observatory, built in 1676, by order of Charles II. at the solicitation of Sir Jonas Moore and Sir Christopher Wren; and furnished with the most accurate instruments; particularly a noble sextant of seven feet radius, with telescopic sights.

2. The Paris observatory, built by the order of Louis XIV. in the Fauxbourg St Jacques.

It is a very singular, but withal a very magnificent building, the design of Monsieur Perault; it is 80 feet high, and at top is a terrace.

The difference in longitude between this and the Greenwich observatory is 2° 20′.

In it is a cave or cellar, of 170 feet descent, for experiments that are to be made far from the sun, &c. particularly such as relate to congelations, refrigerations, indurations, conservations, &c.

3. Tycho Brahe's observatory, which was in the little island Ween, or Scarlet Island, between the coasts of Schonen and Zealand in the Baltic. It was erected and furnished with instruments at his own expence, and called by him *Uraniburg*. Here he spent twenty years in observing the stars; the result is his catalogue.

4. Pekin observatory. Father Le Compte describes a very magnificent observatory, erected and furnished by the late emperor of China, in his capital, at the intercession of some Jesuit missionaries, principally Fa- [illegible], whom he made his chief observer.— [illegible] are exceedingly large; but the divi- [illegible] and the contrivance in some respects [illegible] than that of the Europeans. The [illegible] An armillary zodiacal sphere of six feet dia- [illegible] quinoctial sphere of six feet diameter; an azimuthal horizon of six feet diameter; a large quadrant six feet radius; a sextant eight feet radius; and a celestial globe six feet diameter.

Observatories, as they are very useful, and indeed absolutely necessary for astronomers, so they have become [illegible] more common than they were. There is a very excellent one now at Oxford, built by the trustees of Dr Radcliffe, at the expence of nearly 30,000l. At Cambridge there is as yet no public observatory. Over the great gate of Trinity college, indeed, there is one which is called *Sir Isaac Newton's*, because this great philosopher had used it; but it is gone to decay. It were well if the university would repair and preserve it in memory of that truly great man. In St John's, too, there is a small one. The late ingenious Mr Cotes had used to give lectures in Sir Isaac Newton's on experimental philosophy. There are several very good ones in the Scotch universities; and there is an excellent one lately erected at Dublin.

5. Bramins observatory at Benares. Of this Sir Robert Barker gives the following account, (Phil. Trans. Vol. LXVII. p. 598.) "Benares in the East Indies, one of the principal seminaries of the Bramins or priests of the original Gentoos of Hindostan, continues still to be the place of resort of that sect of people; and there are many public charities, hospitals, and pagodas, where some thousands of them now reside. Having frequently heard that the ancient Bramins had a knowlege of astronomy, and being confirmed in this by their information of an approaching eclipse both of the sun and moon, I made inquiry, when at that place in the year 1772, among the principal Bramins, to endeavour to get some information relative to the manner in which they were acquainted of an approaching eclipse. The most intelligent that I could meet with, however, gave me but little satisfaction. I was told, that these matters were confined to a few, who were in possession of certain books and records; some containing the mysteries

Plate CCCXLVIII.

Obſervatory.

ſteries of their religion; and others the tables of aſtronomical obſervations, written in the Shanſcrit language, which few underſtood but themſelves: that they would take me to a place which had been conſtructed for the purpoſe of making ſuch obſervations as I was inquiring after, and from whence they ſuppoſed the learned Bramins made theirs. I was then conducted to an ancient building of ſtone, the lower part of which, in its preſent ſituation, was converted into a ſtable for horſes, and a receptacle for lumber; but, by the number of court-yards and apartments, it appeared that it muſt once have been an edifice for the uſe of ſome public body of people. We entered this building, and went up a ſtaircaſe to the top of a part of it, near to the river Ganges, that led to a large terrace, where, to my ſurpriſe and ſatiſfaction, I ſaw a number of inſtruments yet remaining, in the greateſt preſervation, ſtupendouſly large, immoveable from the ſpot, and built of ſtone, ſome of them being upwards of 20 feet in height; and although they are ſaid to have been erected 200 years ago, the graduated divisions on the ſeveral arcs appeared as well cut, and as accurately divided, as if they had been the performance of a modern artiſt. The execution in the conſtruction of theſe inſtruments exhibited a mathematical exactneſs in the fixing, bearing, fitting of the ſeveral parts, in the neceſſary and ſufficient ſupports to the very large ſtones that compoſed them, and in the joining and faſtening each into the other by means of lead and iron.

"The ſituation of the two large quadrants of the inſtrument marked A in the plate, whoſe radius is nine feet two inches, by their being at right angles with a gnomon at twenty-five degrees elevation, are thrown into ſuch an oblique ſituation as to render them the moſt difficult, not only to conſtruct of ſuch a magnitude, but to ſecure in their poſition for ſo long a period, and affords a ſtriking inſtance of the ability of the architect in their conſtruction: for, by the ſhadow of the gnomon thrown on the quadrants, they do not appear to have altered in the leaſt from their original poſition; and ſo true is the line of the gnomon, that, by applying the eye to a ſmall iron ring of an inch diameter at one end, the ſight is carried through three others of the ſame dimenſion, to the extremity at the other end, diſtant 38 feet 8 inches, without obſtruction; ſuch is the firmneſs and art with which this inſtrument has been executed. This performance is the more wonderful and extraordinary when compared with the works of the artificers of Hindoſtan at this day, who are not under the immediate direction of an European mechanic. [illegible] arts appear to have declined equally with ſcience in the eaſt.

"Lieutenant Colonel Archibald Campbell, at that time chief engineer in the Eaſt India Company's ſervice at Bengal, made a perſpective drawing of the whole of the apparatus that could be brought within his eye at one view; but I lament he could not repreſent ſome very large quadrants, whoſe radii were about twenty feet, they being on the ſide from whence he took his drawing. Their deſcription however is, that they are exact quarters of circles of different radii, the largeſt of which I judged to be 20 feet, conſtructed very exactly on the ſides of ſtone walls, built perpendicular, and ſituated, I ſuppoſe, in the meridian of the place: a braſs pin is fixed at the centre or angle of the quadrant, from whence, the Bramin informed me, they ſtretched a wire to the circumference when an obſervation was to be made; from which, it occurred to me, the obſerver muſt have moved his eye up or down the circumference, by means of a ladder or ſome ſuch contrivance, to raiſe and lower himſelf, until he had diſcovered the altitude of any of the heavenly bodies in their paſſage over the meridian, ſo expreſſed on the arcs of theſe quadrants: theſe arcs were very exactly divided into nine large ſections; each of which again into ten, making ninety leſſer diviſions or degrees; and thoſe alſo into twenty, expreſſing three minutes each, of about two-tenths of an inch aſunder; ſo that it is probable they had ſome method of dividing even theſe into more minute diviſions at the time of obſervation.

"My time would only permit me to take down the particular dimenſions of the moſt capital inſtrument, or the greater equinoctial ſun dial, repreſented by figure A, which appears to be an inſtrument to expreſs ſolar time by the ſhadow of a gnomon upon two quadrants, one ſituated to the eaſt, and the other to the weſt of it; and indeed the chief part of their inſtruments at this place appear to be conſtructed for the ſame purpoſe, except the quadrants, and a braſs inſtrument that will be deſcribed hereafter.

"Figure B is another inſtrument for the purpoſe of determining the exact hour of the day by the ſhadow of a gnomon, which ſtands perpendicular to, and in the centre of, a flat circular ſtone, ſupported in an oblique ſituation by means of four upright ſtones and a croſs piece; ſo that the ſhadow of the gnomon, which is a perpendicular iron rod, is thrown upon the diviſion of the circle deſcribed on the face of the flat circular ſtone.

"Figure C is a braſs circle, about two feet diameter, moving vertically upon two pivots between two ſtone pillars, having an index or hand turning round horizontally on the centre of this circle, which is divided into 360 parts; but there are no counter diviſions on the index to ſubdivide thoſe on the circle. This inſtrument appears to be made for taking the angle of a ſtar at ſetting or riſing, or for taking the azimuth or amplitude of the ſun at riſing or ſetting.

"The uſe of the inſtrument, figure D, I was at a loſs to account for. It conſiſts of two circular walls; the outer of which is about forty feet diameter, and eight feet high; the wall within about half that height, and appears intended for a place to ſtand on to obſerve the diviſions on the upper circle of the outer wall, rather than for any other purpoſe; and yet both circles are divided into 360 degrees, each degree being ſubdivided into twenty leſſer diviſions, the ſame as the quadrants. There is a door-way to paſs into the inner circle, and a pillar in the centre, of the ſame height with the lower circle, having a hole in it, being the centre of both circles, and ſeems to be a ſocket for an iron rod to be placed perpendicular into it. The diviſions on theſe, as well as all the other inſtruments, will bear a nice examination with a pair of compaſſes.

"Figure E is a ſmaller equinoctial ſun dial, conſtructed upon the ſame principle as the large one A.

"I cannot quit this ſubject without obſerving, that the Bramins, without the aſſiſtance of optical glaſſes,

Observatory || Oby.

Occident || Occupancy.

most considerable: the Tom falls into it in Lat. 58. and the Irtis in Lat. 61. and Long. 86. The exact course of this river was unknown till the country was surveyed by the Russians; who have given us tolerable maps of it and of all Siberia. The Oby forms the boundary between Europe and Asia, and its course is upwards of 2000 miles in length.

OCCIDENT, in geography, the westward quarter of the horizon; or that part of the horizon where the ecliptic, or the sun therein, descends into the lower hemisphere; in contradistinction to *orient*. Hence we use the word *occidental* for any thing belonging to the west; as occidental bezoar, occidental pearl, &c.

OCCIPITAL, in anatomy, a term applied to the parts of the occiput, or back part of the skull.

OCCULT, something hidden, secret, or invisible. The occult sciences are magic, necromancy, cabbala, &c. Occult qualities, in philosophy, were those qualities of body or spirit which baffled the investigation of philosophers, and for which they were unable to give any reason; unwilling however to acknowledge their ignorance, they deceived themselves and the vulgar by an empty title, calling what they did not know *occult*.

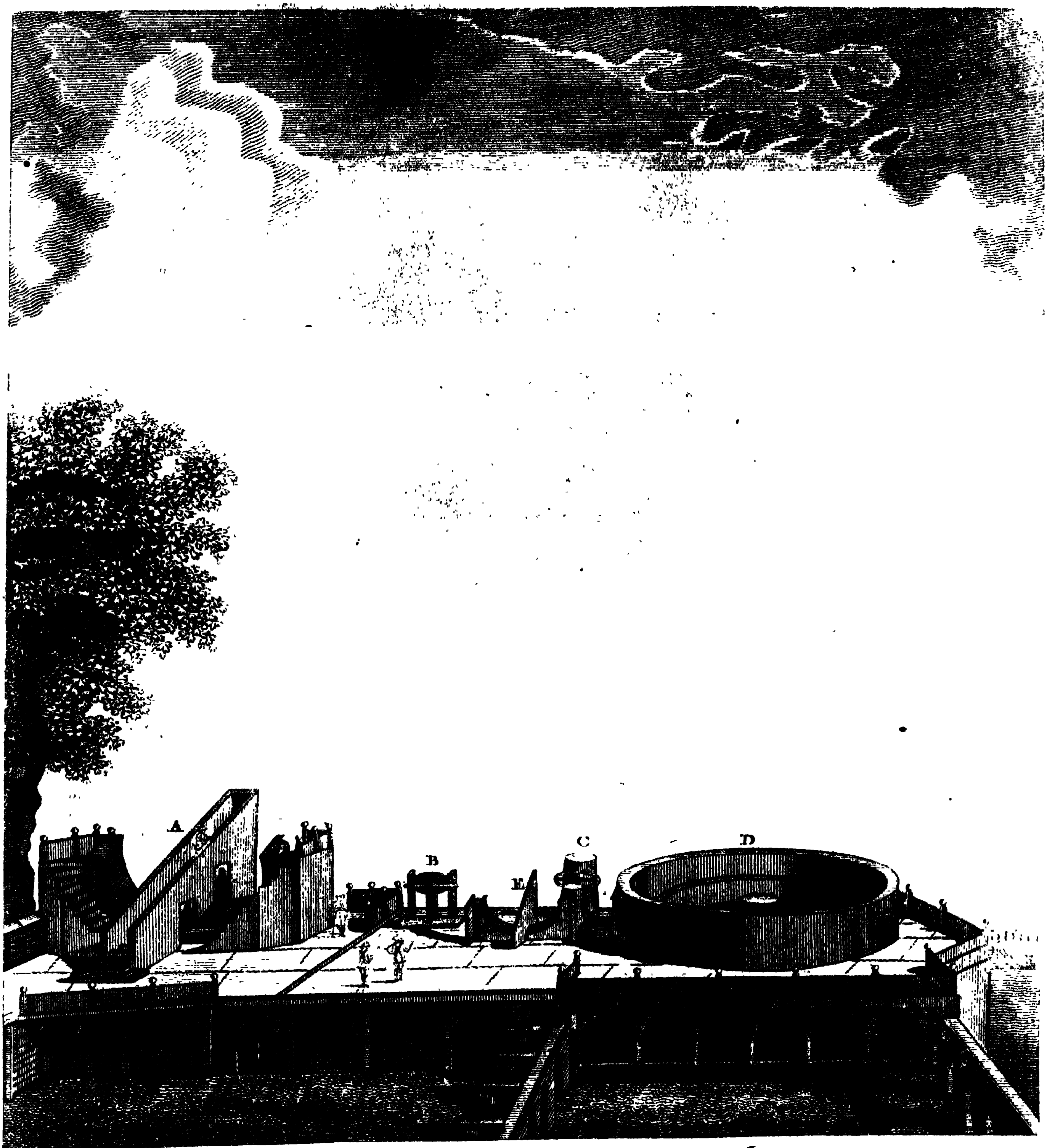
Occult, in geometry, is used for a line that is scarce perceivable, drawn with the point of the compasses or a leaden pencil. These lines are used in several operations, as the raising of plans, designs of building, pieces of perspective, &c. They are to be effaced when the work is finished.

OCCULTATION, in astronomy, the time a star or planet is hid from our sight, by the interposition of the body of the moon or some other planet.

OCCUPANCY, in law, is the taking possession of those things which before belonged to nobody. This is the true ground and foundation of all PROPERTY, or of holding those things in severalty, which by the law of nature, unqualified by that of society, were common to all mankind. But, when once it was agreed that every thing capable of ownership should have an owner, natural reason suggested, that he who could first declare his intention of appropriating any thing to his own use, and, in consequence of such his intention, actually took it into possession, should thereby gain the absolute property of it; according to that rule of the law of nations, recognized by the laws of Rome, *Quod nullius est, id ratione naturali occupanti conceditur*. *Blackst. Comment.*

This right of occupancy, so far as it concerns real property, hath been confined by the laws of England within a very narrow compass; and was extended only to a single instance; namely, where a man was tenant *pour autre vie*, or had an estate granted to himself only (without mentioning his heirs) for the life of another man, and died during the life of *cestuy que vie*, or him by whose life it was holden: in this case, he that could first enter on the land, might lawfully retain the possession so long as *cestuy que vie* lived, by right of occupancy.

This seems to have been recurring to first principles, and calling in the law of nature to ascertain the property of the land, when left without a legal owner. For it did not revert to the granter, who had parted with all his interest, so long as *cestuy que vie* lived; it did




J. Bell Gen. Sculptor fecit.

Occupancy. did not escheat to the lord of the fee; for all escheats must be of the absolute entire fee, and not of any particular estate carved out of it, much less of so minute a remnant as this: it did not belong to the grantee; for he was dead: it did not descend to his heirs; for there were no words of inheritance in the grant: nor could it vest in his executors; for no executors could succeed to a freehold. Belonging therefore to nobody, like the *hæreditas jacens* of the Romans, the law left it open to be seized and appropriated by the first person that could enter upon it, during the life of *cestuy que vie*, under the name of an occupant. But there was no right of occupancy allowed, where the king had the reversion of the lands: for the reversioner hath an equal right with any other man to enter upon the vacant possession; and where the king's title and a subject's interfere, the king's shall always be preferred. Against the king therefore there could be no prior occupant, because *nullum tempus occurrit regi*. And, even in the case of a subject, had the estate *pour autre vie* granted to a man *and his heirs* during the life of *cestuy que vie*, there the heir might, and still may, enter and hold possession, and is called in law a *special occupant*; as having a special exclusive right, by the terms of the original grant, to enter upon and occupy this *hæreditas jacens*, during the residue of the estate granted: though some have thought him so called with no very great propriety; and that such estate is rather a descendible freehold. But the title of *common occupancy* is now reduced almost to nothing by two statutes; the one, 29 Car. II. c. 3. which enacts, that where there is no special occupant, in whom the estate may vest, the tenant *pour autre vie* may devise it by will, or it shall go to the executors, and be assets in their hands for payment of debts: the other that of 14 Geo. II. c. 20. which enacts, that it shall vest not only in the executors, but, in case the tenant dies intestate, in the administrators also; and go in course of a distribution like a chattel interest.

By these two statutes the title of *common occupancy* is utterly extinct and abolished: though that of *special occupancy*, by the heir at law, continues to this day; such heir being held to succeed to the ancestor's estate, not by descent, for then he must take an estate of inheritance, but as an occupant, specially marked out and appointed by the original grant. The doctrine of common occupancy may, however, be usefully remembered on the following account, amongst others: That, as by the common law no occupancy could be of incorporeal hereditaments, as of rents, tithes, advowsons, commons, or the like, (because, with respect to them, there could be no actual entry made, or corporal seisin had; and therefore by the death of the grantee *pour autre vie* a grant of such hereditaments was entirely determined): so now, it is apprehended, notwithstanding those statutes, such grant would be determined likewise; and the hereditaments could not be devisable, nor vest in the executors, nor go in a course of distribution. For the statutes must not be construed so as to create any new estate, or to keep that alive which by the common law was determined, and thereby to defeat the granter's reversion; but merely to dispose of an interest in being, to which by law there was no owner, and which therefore was left open to the first occupant. When there is a residue left, the statutes give it to the executors, &c. instead of the first occupant; but they will not create a residue on purpose to give it to the executors. They only mean to provide an appointed instead of a casual, a certain instead of an uncertain, owner, of lands which before were nobody's; and thereby to supply this *casus omissus*, and render the disposition of the law in all respects entirely uniform; this being the only instance wherein a title to a real estate could ever be acquired by occupancy. Occupancy.

For there can be no other case devised, wherein there is not some owner of the land appointed by the law. In the case of a sole corporation, as a parson of a church, when he dies or resigns, though there be no *actual* owner of the land till a successor be appointed, yet there is a *legal*, *potential*, ownership, subsisting in contemplation of law; and when the successor is appointed, his appointment shall have a retrospect and relation backwards, so as to entitle him to all the profits from the instant that the vacancy commenced. And, in all other instances, when the tenant dies intestate, and no other owner of the lands is to be found in the common course of descents, there the law vests an ownership in the king, or in the subordinate lord of the fee, by escheat.

So also, in some cases, where the laws of other nations give a right by occupancy, as in lands newly created, by the rising of an island in a river, or by the alluvion or dereliction of the sea; in these instances, the law of England assigns them an immediate owner. For Bracton tells us, that if an island arise in the *middle* of a *river*, it belongs in common to those who have lands on each side thereof; but if it be nearer to one bank than the other, it belongs only to him who is proprietor of the nearest shore: which is agreeable to, and probably copied from, the civil law. Yet this seems only to be reasonable, where the soil of the river is equally divided between the owners of the opposite shores: for if the whole soil is the freehold of any one man, as it must be whenever a several fishery is claimed, there it seems just (and so is the usual practice) that the islets, or little islands, arising in any part of the river, shall be the property of him who owneth the piscary and the soil. However, in case a new island rise in the *sea*, though the civil law gives it to the first occupant, yet our's gives it to the king. And as to lands gained from the sea; either by *alluvion*, by the washing up of sand and earth, so as in time to make *terra firma*; or by *dereliction*, as when the sea shrinks back below the usual water mark; in these cases the law is held to be, that if this gain be by little and little, by small and imperceptible degrees, it shall go to the owner of the land adjoining. For *de minimis non curat lex*: and, besides, these owners being often losers by the breaking in of the sea, or at charges to keep it out, this possible gain is therefore a reciprocal consideration for such possible charge or loss. But if the alluvion or dereliction be sudden and considerable, in this case it belongs to the king: for, as the king is lord of the sea, and so owner of the soil while it is covered with water, it is but reasonable he should have the soil when the water has left it dry. So that the quantity of ground gained, and the time during which it is gained, are what make it either the king's or the subject's property. In the same manner, if

if a river, running between two lordships, by degrees gains upon the one, and thereby leaves the other dry; the owner who loses his ground thus imperceptibly has no remedy: but if the course of the river be changed by a sudden and violent flood, or other hasty means, and thereby a man loses his ground, he shall have what the river has left in any other place as recompense for this sudden loss. And this law of alluvions and dereliċtions, with regard to *rivers*, is nearly the same in the imperial law; from whence indeed those our determinations seem to have been drawn and adopted: but we ourselves, as islanders, have applied them to *marine* increases; and have given our sovereign the prerogative he enjoys, as well upon the particular reasons before mentioned, as upon this other general ground of prerogative, which was formerly remarked, that whatever hath no other owner is vested by law in the king. See PREROGATIVE.

OCCUPANT, in law, the person that first seizes or gets possession of a thing.

OCCUPATION, in a legal sense, is taken for use or tenure: as in deeds it is frequently said, that such lands are, or were lately, in the tenure or occupation of such a person.—It is likewise used for a trade or mystery.

OCCUPIERS *of* WALLING, a term used in the salt-works for the persons who are the sworn officers that allot in particular places what quantity of salt is to be made, that the markets may not be overstocked, and see that all is carried fairly and equally between the lord and the tenant.

OCEAN, that huge mass of salt waters which encompasses all parts of the globe, and by means of which, in the present improved state of navigation, an easy intercourse subsists between places the most distant.

The ocean is distinguished into three grand divisions. 1. The Atlantic ocean, which divides Europe and Africa from America, which is generally about 3000 miles wide. 2. The Pacific ocean, or South sea, which divides America from Asia, and is generally about 10,000 miles over. And, 3. The Indian ocean, which separates the East Indies from Africa: which is 3000 miles over. The other seas, which are called *oceans*, are only parts or branches of these, and usually receive their names from the countries they border upon.

For the saltness, tides, &c. of the ocean, see the articles SEA, TIDES, &c.

OCEANIDES (fab. hist.), sea nymphs, daughters of Oceanus, from whom they received their name, and of the goddess Tethys or Thetis. They were 3000 according to Apollodorus, who mentions the names of seven of them; Asia, Styx, Electra, Donis, Eurynome, Amphitrite, and Metis. Hesiod speaks of the eldest of them, which he reckons 41, Pitho, Admete, Prynno, Ianthe, Rhodia, Hippo, Callirhoe, Urania, Clymene, Idyia, Pasithoe, Clythia, Zeuxo, Galuxaure, Plexaure, Perseis, Pluto, Thoe, Polydora, Melobosis, Dione, Cerceis, Xanthe, Acasta, Ianira, Telestho, Europa, Menestho, Petræa, Eudora, Calypso, Tyche, Ocyroe, Crisia, Amphiro, with those mentioned by Apollodorus, except Amphitrite. Hyginus mentions 16 whose names are almost all different from those of Apollodorus and Hesiod; which difference proceeds from the mutilation of the original text. The Oceanides, like the rest of the inferior deities, were honoured with libations and sacrifices. Prayers were offered to them, and they were entreated to protect sailors from storms and dangerous tempests. The Argonauts, before they proceeded to their expedition, made an offering of flour, honey, and oil, on the sea shore, to all the deities of the sea, and sacrificed bulls to them, and entreated their protection. When the sacrifice was made on the sea shore, the blood of the victim was received in a vessel; but when it was in open sea, they permitted the blood to run down into the waters. When the sea was calm, they generally offered a lamb or a young pig; but if it was agitated by the winds and rough, a black bull was deemed the most acceptable victim.



OCEANUS, in Pagan mythology, the son of Cœlus and Terra, the husband of Thetis, and the father of the rivers and fountains, called *Oceanides*. The ancients called him the *Father of all things*, imagining that he was produced by Humidity, which, according to Thales, was the first principle from which every thing was produced. Homer represents Juno visiting him at the remotest limits of the earth, and acknowledging him and Thetis as the parents of the gods. He was represented with a bull's head, as an emblem of the rage and bellowing of the ocean when agitated by a storm.

According to Homer, he was the father even of all the gods, and on that account he received frequent visits from them. He is often, indeed almost always, represented as an old man with a long flowing beard, and sitting upon the waves of the sea. He often holds a pike in his hand, while ships under sail appear at a distance, or a sea monster stands near him. Oceanus presided over every part of the sea, and even the rivers were subjected to his power. The ancients were superstitious in their worship of him, and revered with great solemnity a deity to whose care they intrusted themselves when going on any voyage.

OCEIA, a woman who presided over the sacred rites of Vesta for 57 years with the greatest sanctity. She died in the reign of Tiberius, and the daughter of Domitius succeeded her.

OCELLUS *the* LUCANIAN, an ancient Greek philosopher of the school of Pythagoras, who lived before Plato. His work περι του Παντος, or "The Universe," is the only piece of his which is come down entire to us, and was written originally in the Doric dialect, but was translated by another hand into the Attic. William Christian, and after him Lewis Nogarola, translated this work into Latin; and we have several editions of it, both in Greek and Latin.

OCELOT, the Mexican cat. See FELIS.

OCELOXOCHITL, or TYGER-FLOWER, in botany: A large Mexican plant, composed of three pointed petals, red, but towards the middle of a mixed white and yellow, representing in some degree the spots of that wild animal from which it takes its name. The plant has leaves also resembling those of the iris, and a bulbous root. See Plate CCCL.

OCHINUS (Bernardin), a celebrated Italian, was borne at Siene in 1487, and first became a Cordelier: but he quickly returned into the world, applied himself to the study of physic, and acquired the esteem of Cardinal Julius de Medicis, afterwards Pope Clement VII. At length, again changing his mind, he resum-

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ed his monk's habit in a penitential mood; and not content with this, but aiming at higher perfection, he embraced in 1534 the reformed sect of the Capuchins. He practised, with a most rigorous exactness, all the rules of the order; which, being then in its infancy, he contributed so much to improve and enlarge, that some writers have called him the founder of it. He was certainly made vicar-general of it, and became in the highest degree eminent for his pulpit eloquence. He delivered his sermons with so much grace and politeness, and spoke so copiously, that he ravished his audience wherever he was: never indeed was a man more successful or more applauded. His extraordinary merit procured him the favour of Pope Paul III. who, it is said, made him his father confessor, and preacher. He was thus the darling both of prince and people; when, falling into the company of one John Valde a Spaniard, who had imbibed Luther's doctrine in Germany, he became a proselyte. He was then at Naples, and began to preach in favour of Protestantism; which being observed, he was summoned to appear at Rome; and was in his way thither when he met at Florence Peter Martyr, with whom, it is probable, he had become acquainted at Naples. • This friend persuaded him not to put himself into the pope's power; and they both agreed to withdraw to some place of safety. Ochinus went first to Ferrara, where he disguised himself in the dress of a soldier; and proceeding thence to Geneva, arrived there in 1542, and married a woman of Lucca. He did not, however, settle there, but went to Augsburg, where he published some ser-

In 1547 he was invited, together with Peter Martyr, into England by Archbishop Cranmer, that he might have their joint assistance in carrying on the reformation. They arrived in December; and going to Lambeth, were kindly received by Cranmer. They were entertained there for some time; and Ochinus, as well as Martyr, was made a prebendary of Canterbury (A). He laboured heartily in the conduct of the reformation; and his dialogue upon the unjust usurped primacy of the bishop of Rome, was translated into Latin by Ponet bishop of Winchester, and published in 1549. But upon the death of Edward VI. being forced as well as Martyr to leave England, they retired to Strasburg, where they arrived in 1553. From this city Ochinus went to Basil, and was invited thence in 1555 to Zurich, to be minister of an Italian church which was gathering there. This church consisted of some refugees from Locarno, one of the four bailiwicks which the Switzers possess in Italy; they being hindered from the public exercise of the reformed religion by the opposition of the Popish cantons. Ochinus had no difficulty to subscribe the articles of faith agreed upon by the church of Zurich, and met in that city with Bullinger, who proved a very good friend to him. He governed this Italian church till 1563, when he was banished thence by the magistrates of the town for publishing some dialogues, wherein he defended the doctrine of polygamy. From Zurich he went to Basil; but not being suffered to stay there, he fled in great distress into Moravia, where he fell in with the Socinians, and joined them. Stanislaus Lubienietski, the great patron of this sect, gives the following account of his last days in his *Hist. Reformat. Polon.* Ochinus, says he, retired into Moravia, and into Poland, and even there he was not out of the reach of Calvin's letters. He returned into Moravia after King Sigismund's edict; who in 1564 punished with banishment all those that were called Tritheists, Atheists, &c. Some gentlemen endeavoured to keep him in Poland; but he answered, that men must obey the magistrates, and that he would obey them, even were he to die among the wolves in the woods. During his travels, he fell sick of the plague at Pincksow, and received there all possible offices of kindness from one of the brethren, named Philopovius. His daughter and two sons, whom he carried along with him, died of the plague; but he had buried his wife before he had left Zurich. As for himself, he continued his journey to Moravia, and within three weeks died at Slakow, in 1564, aged 77.

His character is variously represented by different authors, as was to be expected; for men like him have all manner of things, good and bad, said and written of them, by somebody or other. Bayle says, that the confession he made publicly, on the change of his religion, is remarkable. He acknowledged, in a preface, that if he could have continued, without danger of his life, to preach the truth, after the manner he had preached it for some years, he would never have laid aside the habit of his order; but as he did not find himself that courage which is requisite to undergo martyrdom, he took sanctuary in a Protestant country. His writings are numerous but not bulky.



OCHLOCRACY, that form of government wherein the populace have the chief administration of affairs.

OCHNA, in botany: A genus of the monogynia order, belonging to the polyandria class of plants; and in the natural method ranking with those of which the order is doubtful. The corolla is pentapetalous; the calyx pentaphyllous; the berries monospermous, and affixed to a large roundish receptacle.

OCHRE, in natural history, a genus of earths, slightly coherent, and composed of fine, smooth, soft, argillaceous particles, rough to the touch, and readily diffusible in water. Ochres are of various colours, as red, blue, yellow, brown, green, &c.

OCHROMA, in botany: A genus of the pentandria order, belonging to the monodelphia class of plants; and in the natural method ranking under the 37th order, *Columniferæ*. The corolla consists of six petals, three of which are external, and the other three internal; the antheræ unite and form a spiral pillar round the style; the capsule is long, and has five loculaments, and contains a number of black round seeds. Of this there is only one species, viz. the ochroma lagopus, the downtree or corkwood. This tree is frequent in Jamaica, is of speedy growth, and rises to about 25 or 30 feet. The flowers are large and yellow. The capsules are about five inches long, rounded



(A) According to Wood, Athen. Oxon. but it rests solely on his authority, so far as we know.

ed, and covered with a thin ſkin; which when dry falls off in five longitudinal ſegments, and leaves the fruit greatly reſembling a hare's foot. The down is ſhort, ſoft, and ſilky: it is uſed ſometimes to ſtuff beds and pillows; but, like other vegetable downs, is apt to get into clots: an inſipid clear gum exudes from the tree when wounded. The bark is tough, and its fibres are in a reticulated form: it might be made into ropes. The dried wood is ſo very light and buoyant, as to be uſed by the fiſhermen in Jamaica for their nets inſtead of pieces of cork.

OCHUS, a king of Perſia, ſon of Artaxerxes. He was cruel and avaricious; and in order to ſtrengthen himſelf on his throne, he murdered all his brothers and ſiſters. His ſubjects revolted; but he reduced them to obedience, and added Egypt to his other dominions. Bagoas his favourite eunuch poiſoned him for the inſults he had offered to Apis the god of the Egyptians; and he gave his fleſh to be eaten by cats, and made handles for knives with his bones. It ſeems to be not a little remarkable, that all thoſe monſters who diſgraced humanity by their crimes, and ſunk themſelves below the level of brutes, have met with condign puniſhment; and this in general ſeems true, whether we refer to ancient or modern times.—A man of Cyzicus, who was killed by the Argonauts.—A prince of Perſia, who refuſed to viſit his native country for fear of giving all the women each a piece of gold.—A river of India or of Bactriana.—A king of Perſia: He exchanged this name for that of Darius Nothus. See Persia.

OCKHAM, Occam, or Occham (William of), was a celebrated ſcholaſtic divine in the 14th century, of the order of Cordeliers. He was a native of England, and diſciple to the famous Duns Scotus. He was head of the Nominaliſts: and acquired ſo much celebrity, as to be denominated the *Invincible Doctor*.

At the requeſt of Michael de Ceſena, general of his order, he became a party man with Lewis of Raviere, who was an avowed enemy of the church of Rome; and he really wrote vigorouſly againſt Pope John XXII. and his ſucceſſors. Trithemius informs us, that he uſed to ſay to Lewis, "My Lord, let your ſword defend me, and my pen ſhall be always ready to ſupport you." He treated Charles and Clement in a book he wrote againſt them with a groſs ſcurrility.

This, however, was a bold, dangerous, and imprudent ſtep, and cannot well be defended on any proper principle. The effect of it, as might be expected, was an accuſation againſt him and Ceſena. They were charged with maintaining, that neither Chriſt nor his apoſtles had any poſſeſſions at all, either in common or as private property. This doctrine gave riſe to that pleaſant queſtion called the *bread of the Cordeliers;* and conſiſted in determining, whether the dominion of things conſumed in the uſe, ſuch as bread and wine, belonged to them, or only the ſimple uſe of them, without the dominion? Their rule not permitting them to have any thing as property, Pope Nicolas III. who had been of their order, deviſed a method to enrich them, without breaking their rule. To this end he made an ordinance, that they ſhould have only the uſufruct of the eſtates which ſhould be given to them, and that the ſoil and fund of all ſuch donations ſhould belong to the Roman church at large. By this means he gave them the poſſeſſion of an almoſt infinite number of eſtates, in the name of the church of Rome: but on this account, Pope Nicolas's bull was revoked by John XXII. who condemned the uſe without the dominion, by his *Extravaganta ad Conditorem.* He alſo condemned, by another *Extravaganta cum inter,* the doctrine about the poſſeſſion of eſtates by Chriſt and his apoſtles. Ockham and Ceſena were alſo excommunicated, becauſe they had departed from Avignon without the pope's licenſe, and had written againſt him. Ockham, however, was abſolved, as is ſaid, from this cenſure before he died, which was about the year 1347.

We have ſeveral pieces of his, which are written with conſiderable wit and ſubtility. The reformed church ſometimes makes uſe of his reaſoning againſt the church of Rome. Melchior Goldaſt printed, in his treatiſe upon monarchy, 415 queſtions of Ockham. His works are mentioned by many authors.

OCKLEY (Simon), a learned orientaliſt, was born at Exeter in 1678, and educated at Queen's college, Cambridge, where he diſtinguiſhed himſelf by his intenſe application to literature. At the uſual time he took the degrees in arts, and that of bachelor in divinity; but marrying very young, was precluded from a fellowſhip in his college, and this occaſioned his being afterwards involved in many difficulties. In 1705, he was preſented to the vicarage of Swaveſey in Cambridgeſhire; and in 1711 he was choſen Arabic profeſſor of the univerſity. He was perfect maſter of the Arabic and other oriental tongues: the learned Reland ſaid of him. Vir, ſi quis alius harum literarum peritus." Afterwards, however, he had the misfortune to be confined for ſome time in Cambridge caſtle for debt. The above preferments, notwithſtanding, he enjoyed till his death, which happened on the 9th of Auguſt 1720. He wrote, 1. *Introductio ad Linguas Orientales.* 2. The hiſtory of the preſent Jews throughout the world; tranſlated from the Italian of Leo Modena, a Venetian rabbi. 3. The improvement of human reaſon, exhibited in the life of Hai Ebn Yokdhan, tranſlated from the Arabic. 4. An account of South-weſt Barbary, containing what is moſt remarkable in the kingdoms of Fez and Morocco; written by a perſon who had been a ſlave there a conſiderable time, and tranſlated from his manuſcript. 5. The hiſtory of the Saracens, collected from the moſt authentic Arabic authors, in 2 vols. 8vo. He was not only well ſkilled in the learned languages, but alſo in the modern, as French, Spaniſh, Italian, &c.

OCRA, a viſcous vegetable ſubſtance well known in the Weſt Indies, where it is uſed to thicken ſoup, and for other purpoſes.

OCRISIA (fab. hiſt.), the wife of Corniculus, was one of the attendants of Tanaquil the wife of Tarquinius Priſcus. As ſhe was throwing into the flames for offerings ſome of the meats that were ſerved on the table of Tarquin, ſhe ſuddenly ſaw, as is reported, in the fire what Ovid calls *obſcœni forma virilis.* She informed the queen of it; and when by her command ſhe had approached near it, ſhe conceived a ſon who was named Servius Tullius, and was educated in the king's family. He afterwards ſucceeded to the vacant

cant throne. Some ſuppoſe that Vulcan had aſſumed that form which was preſented to the eyes of Ocriſia, and that this god was the father of the ſixth king of Rome.

OCTAETERIS, a cycle or term of eight years, in the Grecian chronology, at the concluſion of which three entire lunar months were added. This cycle was in uſe till Meton's invention of the golden number or cycle of 19 years.

OCTAGON, or OCTOGON, in geometry, is a figure of eight ſides and angles; and this, when all the ſides and angles are equal, is called a *regular octagon*, or one that may be inſcribed in a circle.

OCTAGON, in fortification, denotes a place that has eight baſtions. See FORTIFICATION.

OCTAHEDRON, or OCTAEDRON, in geometry, one of the five regular bodies, conſiſting of eight equal and equilateral triangles.

OCTANDRIA (οκτω "eight," and ανηρ a "man, or huſband,") the 8th claſs in Linnæus's ſexual ſyſtem; conſiſting of plants with hermaphrodite flowers, which are furniſhed with eight ſtamina, or male organs of generation. See BOTANY, p. 430.

OCTANT, or OCTILE, in aſtronomy, that aſpect of two planets, wherein they are diſtant an eighth part of a circle, or 45° degrees from each other.

OCTAPLA, in matters of ſacred literature, denotes a Polyglot Bible, conſiſting of eight columns, and as many different verſions of the ſacred text; viz. the original Hebrew both in Hebrew and Greek characters, Greek verſions, &c.

OCTATEUCH, an appellation given to the eight firſt books of the Old Teſtament.

OCTAVE, in muſic. See INTERVAL.

OCTAVIA, daughter of Caius Octavius and ſiſter to Auguſtus Cæſar. See the following article. She was one of the moſt illuſtrious ladies of ancient Rome; her virtues and her beauty were equally conſpicuous.—Prideaux ſays ſhe was much handſomer than Cleopatra. She married Claudius Marcellus, and after his death M. Antony. Her marriage with Antony was a political match, to reconcile her brother and him together. Antony proved for ſome time attentive to her: but when he had ſeen Cleopatra, he neglected and deſpiſed her; and when ſhe attempted to withdraw him from this illegal amour by going to meet him at Athens, ſhe was rebuked and totally baniſhed from his preſence. This affront was highly reſented by her brother; and though Octavia endeavoured to pacify him by palliating Antony's behaviour, yet he reſolved to revenge her cauſe by arms. After the battle of Actium and the death of Antony, Octavia, forgetful of her own injuries, took into her houſe all the children of her huſband, and treated them with extraordinary tenderneſs. Marcellus, her ſon by her firſt huſband, was married to a niece of Auguſtus, and openly intended as a ſucceſſor to his uncle. His ſudden death plunged all the family into the greateſt grief. Virgil, whom Auguſtus patronized, undertook of himſelf to pay a melancholy tribute to the memory of a young man whom Rome had looked upon as her future father and patron. He was deſired to repeat his compoſition in the preſence of the emperor and his ſiſter. Octavia burſt into tears even when the poet began; but when he mentioned *Tu Marcellus eris*, ſhe ſwooned away. This tender and pathetic encomium upon the merit and the virtues of young Marcellus ſhe liberally rewarded, and Virgil received 10,000 ſeſterces, according to ſome 78l. 2s. 6d. for every one of the verſes. Octavia had two daughters by Antony, Antonia Major and Antonia Minor.—The elder married L. Domitius Ahenobarbus, by whom ſhe had Cn. Domitius, who was the father of the emperor Nero by Agrippina the daughter of Germanicus. Antonia Minor, who was as virtuous and as beautiful as her mother, married Druſus the ſon of Tiberius, by whom ſhe had Germanicus and Claudius, who reigned before Nero. The death of Marcellus conſtantly preyed upon the mind of Octavia, who died of grief or melancholy, about 11 years before the Chriſtian era. Her brother paid great regard to her memory, and pronounced her funeral oration himſelf. The Roman people alſo ſhowed their regard to her virtues, by wiſhing to pay her divine honours.—A daughter of the emperor Claudius by Meſſalina. She was betrothed to Silanus, but by the intrigues of Agrippina, ſhe was married to the emperor Nero in the [illegible]th year of her age. She was ſoon after divorced under pretence of barrenneſs; and the emperor married [illegible] exerciſed her enmity upon Octavia by [illegible] to be baniſhed into Campania. She [illegible] recalled by the people; but Poppæa, [illegible]rmined on her ruin, cauſed her again to [illegible] to an iſland, where ſhe was ordered to kill [illegible]pening her veins. Her head was cut off [illegible] Poppæa.

[illegible]IANUS, or OCTAVIUS CÆSAR, was ne[illegible]lius Cæſar the dictator, being the ſon of Accia his ſiſter, by Octavius a ſenator, and afterwards became the ſecond emperor of Rome. He was born in the year of the city 691, during the conſulſhip of Cicero. His uncle Julius Cæſar adopted him, and left him the greateſt part of his fortune. When he was but 20 years of age, he was raiſed to the conſulſhip. His youth and inexperience were ridiculed by his enemies; notwithſtanding which obſtacle, his prudence and valour raiſed his conſequence. He made war againſt his opponents on pretence of avenging the aſſaſſination of his uncle. He engaged in five civil wars with great ſucceſs, viz. The wars of Mutina, Peruſia, Philippi, Sicily, and Actium: the firſt and laſt of which were againſt M. Antony; the ſecond againſt L. Antony, brother of the triumvir; the third was againſt Brutus and Caſſius; and the fourth againſt Sext. Pompey, ſon of Pompey the Great. He united his forces with Antony's at the battle of Philippi; and had he not been ſupported by the activity and bravery of his colleague, he would doubtleſs have been totally ruined in that engagement. In this triumvirate with Antony and Lepidus, he obtained the weſtern parts of the Roman empire; and, like his other colleagues, more firmly to eſtabliſh his power, he proſcribed his enemies and cut them off. The triumvirate laſted for 10 years. He had given his ſiſter Octavia in marriage to Antony, to make their alliance more laſting; but when Cleopatra had charmed this unfortunate man, Octavia was repudiated. Auguſtus immediately took up arms to avenge the wrongs of his ſiſter; but perhaps more

more eager to remove a man whose power and existence kept him in continual fear and constant dependence. Both parties met at Actium to decide the fate of Rome. Antony was supported by all the power of the east, and Augustus by Italy. Cleopatra fled from the battle with 60 ships; and her flight ruined the interest of Antony, who followed her into Egypt. The conqueror soon after went into Egypt likewise, besieged Alexandria, and honoured with a magnificent funeral his unfortunate colleague and the celebrated queen, whom the fear of being led in the victor's triumph at Rome had driven to commit suicide. After he had established peace all over the world, he shut the gates of the temple of Janus, A. U. C. 753. He was twice determined to lay down the supreme power immediately after the victory obtained over Antony, and on account of his ill health; but his two faithful friends Mecænas and Agrippa dissuaded him, and contended, that if he did he would leave it to be the prey of the most powerful, and expose himself to the greatest dangers. He died at Nola in the 76th year of his age, after he had held the sovereign power for 57 years.—He was an active emperor, and consulted the good of the Romans with the greatest anxiety and care. He visited all the provinces except Africa and Sardinia, and his consummate prudence and experience occasioned many salutary laws. He is, ho[illegible] accused of licentiousness and adultery; [illegible] goodness of his heart, the fidelity of his frien[illegible] and the many good qualities which the poets whom [illegible] nized have perhaps truly celebrated, [illegible] though in the eye of strict religion and true [illegible] ty but little, amends for his natural foibles. He was ambitious of being esteemed handsome; and as he was publicly reported to be the son of Apollo according to his mother's declaration, he wished his flatterers to represent him with the figure and attributes of that god. Like Apollo, his eyes were clear, and he affected to have it thought that they possessed some divine irradiation, and was well pleased if, when he fixed his eyes upon any body, they held down their eyes as if overcome by the glaring brightness of the sun. He distinguished himself by his learning; he was a complete master of the Greek language, and wrote some tragedies, besides memoirs of his life and other works, which are now lost. He married four times; but he was unhappy in all these connexions; and his only daughter Julia disgraced herself and her father by the debauchery and licentiousness of her manners. He recommended at his death his adopted son Tiberius as his successor. He left his fortune partly to him and to Drusus, and made donations to the army and Roman people. The title of Augustus was conferred upon him by the senate after the battle of Actium and the final destruction of the Roman republic. The title continued afterwards, being given to his successors in the empire. Virgil is said to have written his Æneid at the desire of Augustus, whom he represents under the amiable and perfect character of Æneas. The name of Octavius was very common at Rome; it was the name of a variety of men of very considerable rank.

OCTOBER, in chronology, the eighth month of Romulus's year, which the name implies; but tenth in the kalendar of Numa, Julius Cæsar, &c. The senate gave this month the name *Faustinus*, in compliment to Faustina, the wife of the emperor Antoninus; Commodus would have it called *Invictus*; and Domitian named it *Domitianus*; but in spite of all these attempts it still retains its original name. This month was sacred to Mars, and under his protection.



*October Equus*, a horse annually sacrificed to Mars in the month of October, either because the horse is a warlike animal, or to punish him for the taking of Troy. A race was run with chariots, drawn by two horses, previous to the sacrifices, and he that ran quickest was adjudged to be the victim.

OCTOSTYLE, in the ancient architecture, is the face of an edifice adorned with eight columns.

OCULUS, the EYE, in anatomy. See there, N° 142.

*Oculus Beli*, in natural history, one of the semipellucid gems, of a grayish white colour, variegated with yellow and with a black central nucleus: it is of a roundish form, and its variegations very beautifully represent the pupil and iris of the eye; whence the name.

*Oculus Mundi*, or *Lapis Mutabilis*. See HYDROPHANES.

*Oculus Cati*. See ASTERIA.

OCYMOPHYLLON, in botany: a name given by Buxbaum to a new genus of plants, the characters of which are these: The flower is of the stamineous kind, having no petals; this stands upon the embryo fruit, which afterwards becomes an oblong quadrangular seed-vessel, divided into four cells, and containing roundish and very small seeds; its leaves are like those of the common ocymum or basil, whence its name; and its place of growth is in damp marshes. Boccone has described it under the improper name of *glaux*, calling it the *great, green-flowered, marsh glaux*.

OCYMUM, BASIL; a genus of the gymnospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The upper lip of the calyx is orbiculated, the inferior one quadrifid; the corolla is resupinated, with one lip quadrifid, the other undivided; the exterior filament sends out a reflected process at the base. There are eight species, all of them natives of warm climates, rising from six inches to two feet in height, and having a strong aromatic smell, resembling that of cloves. One of the species is used in the kitchen, particularly by the French cooks, who make great use of it in their soups and sauces. This rises about ten inches high, sending out branches by pairs opposite, from the bottom; the stalks and branches are four-cornered; the leaves are oval, spear-shaped, ending in acute points, and are indented on their edges; the whole plant is hairy, and has a strong scent of cloves too powerful for most persons, but to some it is very agreeable. These plants are propagated by seeds, and will thrive in this country in the open air, and will even ripen their seeds if placed in a stove or airy glass-case.

OCZAKOW, or OCZAKOFF, a town of Turkey in Europe, and capital of a sangiack of the same name, inhabited by Tartars. During a late war, here was a Turkish garrison of 20,000 men. However, it was taken by the Russians in 1737, and all those that resisted were put to the sword. The Russians themselves lost

18,000

18,000 men in the assault. The Turks returned the same year with 70,000 men to retake it; but were obliged to retire, after the loss of 20,000. In 1738, the Russians withdrew their garrison, and demolished the fortifications. It is seated on the river Bog, to the west of the Nieper, or rather where they both unite and fall into the Black sea. It is 42 miles south-west of Bialagrod, and 190 north by east of Constantinople. It has been lately a subject of great contest between the Russians and Turks. The affair is fresh in our readers memories; but the following more particular account of the place, will not, we trust, be unacceptable to our readers.—It is called by the Turks *Dzain Crimenda*, is seated at the influx of the Nieper into the Black sea, 120 miles from Bender, to the south-east. The river is here above a mile broad. Hither the Turkish galleys retire which guard the mouth of the river, to prevent the Cossacks from pirating upon the Black sea. Here is no port, but good anchorage. It is defended by a castle, surrounded with walls 25 feet high; those of the town are much lower. There are about 2000 people at Oczakow. Below the castle are two towns or suburbs, situated on the declivity of a hill, which on the other side has nothing but precipices. To the south of these towns is another small castle, where is some artil[illegible] to prevent vessels from coming up the river. Here is also a tower, in which are always some Turks upon the watch to discover from afar any of the Cossacks at sea, and give notice of them to the galleys by a signal. The city is inhabited by Tartars, though garrisoned by Turks. E. Long. 30. 50. N. Lat. 46. 50.

ODA, in the Turkish seraglio, signifies a class, order, or chamber. The grand signior's pages are divided into five classes or chambers. The first, which is the lowest in dignity, is called the *great oda*, from the greater number of persons that compose it; these are the juniors, who are taught to read, write, and speak the languages. The second is called the *little oda*, where from the age of 14 or 15 years, till about 20, they are trained up to arms, and the study of all the polite learning the Turks are acquainted with. The third chamber, called *kilar oda*, consists of 200 pages, who, besides their other exercises, are under the command of the kilardgi-bachi, and serve in the pantry and fruitery. The fourth consists only of 24, who are under the command of the khazineda-bachi, and have charge of the treasure in the grand signior's appartment, which they never enter with clothes that have pockets. The fifth is called *kas oda* or *privy-chamber*; and is composed of only 40 pages who attend in the prince's chamber. Every night eight of these pages keep guard in the grand signior's bedchamber while he sleeps: they take care that the light, which is constantly kept in the room, does not glare in his eyes, lest it should awake him: and if they find him disturbed with troublesome dreams, they cause him to be awaked by one of their agas.

*ODA Bachi*, or *Oddabassi*, an officer in the Turkish soldiery, equivalent to a serjeant or corporal among us. The common soldiers and janizaries, called *oldachis*, after having served a certain term of years, are always preferred and made biquelairs; and of biquelairs in time become odobachis, i. e. corporals of companies, or chiefs of certain divisions, whose number is not fixed; being sometimes ten, and sometimes twenty.

Their pay is six doubles per month; and they are distinguished by a large felt, a foot broad and above a foot long, hanging on the back, with two long ostrich feathers.

ODE, in poetry, a song, or composition proper to be sung. See POETRY.

ODED, a prophet of the Lord, who being at Samaria, when the Israelites of the ten tribes returned from the war, with their King Pekah, together with 200,000 of the people of Judah captives, he went out to meet them, and said, "You have seen that the Lord God of your fathers was in wrath against Judah; he has therefore delivered them into your hands, and you have slain them inhumanly, so that your cruelty has ascended up into heaven; and more than this, you would make slaves of the children of Judah, who are your brethren, and would add this sin to the many others you have committed: therefore, hear the counsel that I give you; send back these captives, lest the Lord should pour out his fury upon you." Oded having done speaking, some of the chiefs of Samaria seconded him, and by their remonstrances prevailed with the Israelites to set the captives at liberty (2 Chron. xxviii.) See AHAZ.

The enlargement of the captives being obtained, the principal men of Samaria took care of them, gave them clothes and food and other necessary assistance. After which they furnished them with horses, because the greatest part of them were so tired and exhausted that they were not able to walk. Thus they conducted them to Jericho, which was in the confines of the land of Judah. This is all that is come to our knowledge concerning the prophet Oded.

ODENSEE, the capital of the isle of Funen, a place of such high antiquity, that some Danish writers derive its foundation and name from Odin the god and hero of the Gothic nations. "Its name certainly occurs (says Mr Coxe) in the earliest ages of the Danish history; and it was town of great note long before Copenhagen existed. Odensee stands upon a small river, not navigable, and about two miles from the bay of Stegestrand. Many of the houses are ancient, bearing dates about the middle of the 16th century; but part is newly built: it contains about 5200 inhabitants, who carry on some commerce, exporting chiefly grain and leather; the latter is much esteemed, and its goodness is supposed to arise from a certain property in the river water, in which it is soaked for tanning. The Danish cavalry are supplied from thence with the greatest part of their leathern accoutrements.

"Odensee is the seat of a bishop, which was founded by Harold Blaatand in 980, and is the richest in Denmark next to Copenhagen. It has a school, endowed by the celebrated Margaret of Valdemar, in which a certain number of scholars, from six to 16 years of age, are instructed gratis: they live and board in the town, and each receives a yearly pension; other scholarships have been also founded by private persons. The whole number amounted to 70. There is also a gymnasium, instituted by Christian IV. for the admission of students at the age of 16. The seminary

was

Odenatus || Odin. was still further improved by the liberality of Holberg the Danish historian, who protected letters with the same zeal with which he cultivated them. It is now greatly fallen from its former flourishing state, containing, when I passed through the town, only eight students. The cathedral is a large old brick building, which has nothing remarkable except some costly monuments of a private Danish family. The church, which formerly belonged to the convent of Recolets, contains the sepulchre of John king of Denmark, and of his son Christian II." E. Long. 10. 27. N. Lat. 55. 28.

ODENATUS, a celebrated prince of Palmyra. He very early inured himself to bear fatigues, and by hunting leopards and wild beasts, accustomed himself to the labours of a military life. He was a faithful friend to the Romans; and when Aurelian had been taken prisoner by Sapor king of Persia, Odenatus warmly interested himself in his cause, and solicited his release, by writing to the conqueror, and by sending him presents. The king of Persia was offended at this liberty of Odenatus, he tore the letter, and ordered the presents that were offered to be thrown into a river, and in order to punish Odenatus, who had the impudence, as he called it, to pay homage to so great a monarch as himself, he commanded him to appear before him, on pain of being devoted to instant destruction with all his family, if he dared to refuse. Odenatus despised this haughty summons of Sapor, and opposed force by force. He obtained some considerable advantages over the troops of the Persian king and took his wife prisoner, with a great and rich booty. These services were observed with gratitude by the Romans; and Gallienus, the then emperor, named Odenatus as his colleague on the throne, and gave the title of *Augustus* to his children, and to his wife the celebrated Zenobia. Odenatus invested with new power, resolved to signalize himself more conspicuously by conquering the barbarians of the north: but his exulting was of short duration: he perished by the dagger of one of his own relations, whom he had slightly offended at a domestic entertainment.—He died at Emessa about the 267th year of the Christian era. Zenobia succeeded to his titles and honours.

ODER, a river of Germany, which has its source near a town of the same name in Silesia, and on the confines of Moravia. It runs north through that province, and then into the Marche of Brandenburg and Pomerania, where it forms a large lake, afterwards falling into the Baltic sea by three mouths; between which lie the islands Usedom and Wolin. It passes by several towns; as Ratibor, Oppelen, Breslau, Glogan and Grossen, in Silesia; Francfort, Lebus, and Custrin, in Brandenburg; and Gartz, Stetin, Cammin, Wallin, Usedom, and Wolgast, in Pomerania.

ODEUM, in Grecian antiquity, a music theatre built by Pericles; the inside of which was filled with seats and ranges of pillars, and on the outside the roof descended shelving downwards from a point in the centre, with many bendings, in imitation of the king of Persia's pavilion. Here the musical prizes were contended for; and here also, according to Aristophanes was a tribunal.

ODIN (see FREA), in mythology, called also in the dialect of the Anglo-Saxons, *Woden* or *Wodan*, a name given by the ancient Scythians to their supreme god, and assumed, about 70 years before the Christian era, by Sigge, a Scythian prince, who conquered the northern nations, made great changes in their government, manners, religion, and enjoyed great honours, and had even divine honours paid him. According to the account given of this conqueror by Snorro, the ancient historian of Norway, and his commentator Torfæus, Odin was a Scythian, who withdrew himself, with many others in his train, by flight, from the vengeance of the Romans, under the conduct of Pompey; and having officiated as a priest in his own country, he assumed the direction of the religious worship, as well as the civil government, of the nations which he conquered. Having subdued Denmark, Sweden, and Norway, he retired to Sweden, where he died. There is nothing certain in this account; but it is probable, that the god, whose prophet or priest this Scythian pretended to be, was named *Odin*, and that the ignorance of succeeding ages confounded the deity with his priest, composing out of the attributes of the one, and the history of the other, the character of the northern conqueror. He deluded the people by his enchantments and skill in magic: having cut off the head of one Mimer, who in his lifetime was in great reputation for wisdom, he caused it to be embalmed, and persuaded the Scandinavians that he had restored it to the use of speech; and he caused it to pronounce whatever oracles he wanted. The Icelandic chronicles represent Odin as the most eloquent and persuasive of men; they ascribe to him the introduction of the art of poetry among the Scandinavians, and likewise the invention of the Runic characters. He had also the address to persuade his followers, that he could run over the world in the twinkling of an eye; that he had the direction of the air and tempests; that he could transform himself into all sorts of shapes, could raise the dead, could foretel things to come, deprive his enemies, by enchantment, of health and vigour, and discover all the treasures concealed in the earth. They add, that by his tender and melodious airs, he could make the plains and mountains open and expand with delight; and that the ghosts, thus attracted, would leave their infernal caverns, and stand motionless about him. Nor was he less dreadful and furious in battle; changing himself into the shape of a bear, a wild bull, or a lion, and amidst ranks of enemies committing the most horrible devastation, without receiving any wound himself.

Dr Henry gives this account of him: "Odin is believed to have been the name of the one true God among the first colonies who came from the east and peopled Germany and Scandinavia, and among their posterity for several ages. But at length a mighty conqueror, the leader of a new army of adventurers from the east, over-run the north of Europe, erected a great empire, assumed the name of *Odin*, and claimed the honours which had been formerly paid to that deity. From thenceforward this deified mortal, under the name of *Odin* or *Wodin*, became the chief object of the idolatrous worship of the Saxons and Danes in this island, as well as of many other nations. Having been a mighty and successful warrior, he was believed to be the god of war, who gave victory, and revived *Henry's Hist. of Britain, Vol. II.*

revived courage in the conflict. Having civilized, in some measure, the countries which he conquered, and introduced arts formerly unknown, he was also worshipped as the god of arts and artists. In a word, to this Odin his deluded worshippers impiously ascribed all the attributes which belong only to the true God: to him they built magnificent temples, offered many sacrifices, and consecrated the fourth day of the week, which is still called by his name in England and in all the other countries where he was formerly worshipped. Notwithstanding all this, the founders of all the kingdoms of the Anglo-Saxon heptarchy pretended to be descended from Wodin, and some of them at the distance only of a few generations."

*Odin's Fire*. We have this account of it in Gough's Camden. "In Evie parish, in the Orkneys, near the sea, are some rocks, which frequently in the night appear on fire; and the church of St Michael there was often seen full of lights, called fires sent by Odin to guard their tombs, but now ceased. This may be a meteor, or some inflammable matter on the cliffs, as at Charmouth, Dorset."

ODINUS, a celebrated hero of antiquity, who flourished about 70 years before the Christian era, in the northern parts of ancient Germany, or in the modern kingdom of Denmark. He was at the same time a priest, a soldier, a poet, a monarch, and a victor. He imposed upon the credulity of his superstitious countrymen, and made them believe that he could raise the dead, and that he was acquainted with futurity. When he had extended his power, and increased his fame by conquest and by artifice, he determined to die in a different way from other men. He assembled his friends, and with the sharp point of a lance he made in his body nine different wounds in the form of a circle; and when expiring he declared that he was going to Scythia, where he should become an immortal god. He added, that he would prepare bliss and felicity for those of his countrymen who lived a virtuous life, who fought with bravery, and who died like heroes in the field of battle. These injunctions had the wished-for effect: his countrymen superstitiously believed him, and constantly recommended themselves to his protection when they engaged in battle; and they entreated him to receive the souls of such as fell in war.

*De Odio et Atia*. See *False Imprisonment*.

The writ *de odio et atia* was anciently used to be directed to the sheriff, commanding him to inquire whether a prisoner charged with murder was committed upon just cause of suspicion, or merely *propter odium et atiam*, for hatred and ill will; and if upon the inquisition due cause of suspicion did not then appear, then there issued another writ for the sheriff to admit him to bail. This writ, according to Bracton, ought not to be denied to any man; it being expressly ordered to be made out *gratis*, without any denial, by *magna charta*, c. 26. and statute Westm. 2. 13 Edw. I. c. 29. But the statute of Glocester, 6 Edw. I. c. 9. restrained it in the case of killing by misadventure or self defence, and the statute 28 Edw. III. c. 9. abolished it in all cases whatsoever: but as the stat. 42 Ed. III. c. 1. repealed all statutes then in being, contrary to the great charter, Sir Edward Coke is of opinion that the writ *de odio et atia* was thereby revived. See *Habeas Corpus*.



ODO (St,) second abbot of Cluny in France, was illustrious for learning and piety in the 10th century. The sanctity of his life contributed greatly to enlarge the congregation of Cluny; and he was so esteemed, that popes, bishops, and secular princes, usually chose him the arbiter of their disputes. He died about the year 942, and his works are printed in the Bibliotheque of Cluny.

*Odo Cantianus*, so called as being a native of Kent in England, was a Benedictine monk in the 12th century, in which order his learning and eloquence raised him to the dignity of prior and abbot. Archbishop Becket was his friend; and his panegyric was made by John of Salisbury. He composed Commentaries on the Pentateuch, and the Second Book of Kings; Moral Reflections on the Psalms; treatises entitled, *De Onere Philistim*; *De Moribus Ecclesiasticis*; *De Vitiis et Virtutibus Animæ*, &c.

ODOACER, according to Ennodius, was meanly born, and only a private man in the guards of the emperor Augustulus, when (A. D. 476, under the consulship of Basilicus and Armatus) the barbarians chose him fo ———— The barbarians thought, as they often defended Italy, they had a right at least to part of it; but upon demanding it they were refused, and the consequence was a revolt. Odoacer is said to have been a man of uncommon parts, capable alike of commanding an army or governing a state. Having left his own country when he was very young, to serve in Italy, as he was of a stature remarkably tall, he was admitted among the emperor's guards, and continued in that station till the above year; when, putting himself at the head of the barbarians in the Roman pay, who, though of different nations, had unanimously chosen him for their leader, he marched against Orestes, and his son Augustulus, who still refused to share any of the lands in Italy. The Romans were inferior both in numbers and valour, and were easily conquered: Orestes was ordered to be slain; but the emperor Augustulus was spared, and, though stripped of his dignity, was treated with humanity, and allowed a liberal sum for his own support and for that of his relations. Odoacer was proclaimed king of Italy; but assumed neither the purple nor any other mark of imperial consequence. He was afterwards defeated and slain by Theodoric the Ostrogoth. See Ostrogoth.

ODONTALGIA, the toothach. See Medicine, N° 210 and 411.

ODONTOIDE, in anatomy, an appellation given to the process of the second vertebra of the neck, from its resemblance to a tooth.

ODOROUS, or Odoriferous, appellations given to whatever smells strongly, whether they be fetid or agreeable; but chiefly to things whose smell is brisk and pleasant.

ODYSSEY, the name of an epic poem composed by Homer, which, when compared with the Iliad, exhibits its author as the setting sun, whose grandeur remains without the heat of his meridian beams.

The poet's design in the Odyssey was to paint the miseries of a kingdom in the absence of its supreme governor, and the evil consequences resulting from a disregard of law, and of that subordination without which society cannot exist. With this view he sets before

before his countrymen the adventures of a prince who had been obliged to forsake his native country, and to head an army of his subjects in a foreign expedition; and he artfully contrives, without interrupting the narrative, to make the reader acquainted with the state of the country in the absence of its sovereign. The chief having gloriously finished the enterprise in which he was engaged, was returning with his army; but in spite of all his eagerness to be at home, he was detained on the way by tempests for several years, and cast upon several countries differing from each other in manners and in government. In these dangers his companions, not strictly obeying his orders, perish through their own fault. In the mean time the grandees of his country abuse the freedom which his absence gave them; consume his estate; conspire to destroy his son; endeavour to compel his queen to accept one of them for her husband; and indulge themselves in every species of violence, from a persuasion that he would never return. In this they were disappointed. He returns; and discovering himself only to his son and some others who had maintained their allegiance, he is an eye witness of the insolence of his enemies, punishes them according to their deserts, and restores to his island that tranquillity and repose to which it had been a stranger during the many years of his absence.

Such is the fable of the Odyssey, in which there is no opportunity of displaying that vigour and sublimity which characterize the Iliad. "It descends from the dignity of gods and heroes †, and warlike achievements; but in recompense we have more pleasing pictures of ancient manners. Instead of that ferocity which reigns in the other poem, this presents us with the most amiable images of hospitality and humanity; entertains us with many a wonderful adventure; and instructs us by such a constant vein of morality and virtue which runs through the poem," sometimes in precepts, and always in the conduct of the hero, that we should not wonder if Greece, which gave the appellation of *wise* to men who uttered single sentences of truth, had given to Homer the title of *the father of virtue*, for introducing into his work such a number of moral maxims. As a poem, however, the Odyssey has its faults. The last twelve books are tedious and languid; and we are disappointed by the calm behaviour of Penelope upon the discovery of her long lost husband.

† *Blair's Lectures.*

OECONOMICS, the art of managing the affairs of a family or community; and hence the person who takes care of the revenues and other affairs of churches, monasteries, and the like, is termed *œconomus*.

OECONOMY, denotes the prudent conduct, or discreet and frugal management, whether of a man's own estate or that of another.

*Animal* OECONOMY, comprehends the various operations of nature in the generation, nutrition and preservation of animals †. The doctrine of the animal economy is nearly connected with physiology, which explains the several parts of the human body, their structure, use, &c. See ANATOMY and MEDICINE.

† See *Generation*, *Nutrition*, &c.

OECUMENICAL, signifies the same with *general* or *universal*; as, œcumenical council, bishop, &c.

OEDEMA, or PHLEGMATIC TUMOUR, in medicine and surgery, a sort of tumour attended with pale-



old, yielding little resistance, retaining the print of the finger when pressed with it, and accompanied with little or no pain.

This tumour obtains no certain situation in any particular part of the body, since the head, eyelids, hands, and sometimes part, sometimes the whole body, is afflicted with it. When the last mentioned is the case, the patient is said to be troubled with a cachexy, leucophlegmatia, or dropsy. But if any particular part is more subject to this disorder than another, it is certainly the feet, which are at that time called *swelled* or *œdematous feet*.

OEDERA, in botany: A genus of the polygamia segregata order, belonging to the syngenesia class of plants. The calyces are multiflorous; the corollets tubular, hermaphrodite, and one or two feminine ones ligulate; the receptacle is chaffy; the pappus with numerous chaff.

OEDIPUS, the unfortunate king of Thebes, whose history is partly fabulous, flourished about 1266 B. C. It is said he was given by his father to a shepherd, who was ordered to put him to death, in order to prevent the misfortunes with which he was threatened by an oracle. But the shepherd, being unwilling to kill him with his own hands, tied him by the feet to a tree, that he might be devoured by wild beasts. The infant was however found in this situation by another shepherd named *Phorbas*, who carried him to Polybus king of Corinth; where the queen, having no children, educated him with as much care as if he had been her own son. When he was grown up, he was informed that he was not the son of Polybus: on which, by order of the oracle, he went to seek for his father in Phocis; but scarce was he arrived in that country, when he met his father on the road, and killed him without knowing him. A short time after, having delivered the country from the monster called the *Sphinx*, he married Jocasta, without knowing that she was his mother, and had four children by her; but afterwards, being informed of his incest, he quitted the throne, and, thinking himself unworthy of the light, put out his eyes. Eteocles and Polynices, who were celebrated amongst the Greeks, were born of this incestuous marriage.

OEGWA, a town on the Gold coast of Africa, standing, according to Artus, on the brow of an eminence, raising itself by a gentle ascent to a considerable height, and defended by rocks, against which the waves beat with the utmost violence, the noise of which is heard at a great distance.

Barbot affirms, that Oegwa contains above 500 houses disjoined by narrow crooked streets; and that from the sea it has the appearance of an amphitheatre. Des Marchias reduces the number of houses to 200, in the centre of which stands a large square building, the repository of their gold dust and other commodities. The houses are built of earth and clay, but convenient, and well furnished with chairs, stools, mats, carpets, earthen pots, and even looking glasses, which last they purchase from the Europeans. No part of the coast is better provided with all kinds of eatables, which are sent in from the adjacent cantons, and sold in public markets. Every thing is bought and sold with gold dust, which is the standard of all other commodities, and brought hither in great abundance

dance from all quarters of Fetu, Abrambo, Affiento, and Mandingo. The gold is fold by weight, and the quantity determined by nice fcales, made in the country before it was frequented by the Europeans: a proof that thofe negroes are not wholly ignorant of the more refined principles of mechanics. Next to gold, the chief commerce of the place confifts in the fale of fifh, of which they catch prodigious quantities on the coaft. Although the natives are brave and warlike, yet in time of peace no people are more induftrious, their whole time being employed in catching fifh or cultivating the fruits of the earth. They are extremely expert in throwing the line, and fifhing by the hook; nor is their intrepidity in combating the elements, and purfuing their employments in all kinds of weather, lefs aftonifhing. Every day in the week, except Wednefday, which is facred to the Fetiche, they employ in their feveral occupations, and no feafon of the year is exempted from fifhing. Their canoes weather ftorms which would endanger the largeft fhipping; and the negroes have the dexterity of making their advantage of thofe feafons, which oblige others to difcontinue their labours, by throwing their lines with the fame fuccefs in tempeftuous as in calm weather.

OELAND, an ifland of Sweden, feated on the Baltic fea, between the continent of Gothland and the ifle of Gothland. It lies between 56° and 57° of north latitude, and between 17° and 18° of eaft longitude. It is about 60 miles in length, and 15 in breadth; having a wholefome air, and a fertile foil, with rifing hills, and feveral caftles. It has no town of any great note.

OENANTHE, WATER DROPWORT: A genus of the digynia order, belonging to the pentandria clafs of plants; and in the natural method ranking under the 45th order, *Umbellatæ*. The florets are difform; thofe of the difc feffile and barren; the fruit crowned with the calyx. There are five fpecies; of which the moft remarkable is the crocata, or hemlock dropwort, growing frequently on the banks of ditches, rivers, and lakes, in many parts of Britain. The root and leaves of this plant are a ftrong poifon; feveral perfons have perifhed by eating it through miftake, either for water parfnips or for celery, which laft it refembles pretty much in its leaves. So exceedingly deleterious is this plant, that Mr Lightfoot tells us he has heard the late Mr Chriftopher d'Ehret, the celebrated botanic painter, fay, that while he was drawing it, the fmell or effluvia only rendered him fo giddy, that he was feveral times obliged to quit the room, and walk out in the frefh air to recover himfelf; but recollecting at laft what might be the probable caufe of his repeated illnefs, he opened the door and windows of the room, and the free air then enabled him to finifh his work without any more returns of the giddinefs. Mr Lightfoot informs us, that he has given a fpoonful of the juice of this plant to a dog, but without any other effect than that of making him very fick and ftupid. In about an hour he recovered; and our author has feen a goat eat it with impunity. To fuch of the human fpecies as have unfortunately ate any part of this plant, a vomit is the moft approved remedy.

Lobel calls this vegetable *œnanthe aquatica cicutæ facie*. It grows in great plenty all over Pembrokefhire, and is called by the inhabitants *five-fingered root*: it is much ufed by them in cataplafms for the felon or worft kind of whitlow. They eat fome parts of it, but carefully avoid the roots or ftalk. Thefe indeed are of a moft pernicious nature, and never fail to prove inftantly fatal, unlefs a proper remedy is applied. The following inftance, in addition to what has been faid, of the effects of this plant on man, is given in the Gentleman's Magazine for July 1747.

Three French prifoners being in the fields near the town of Pembroke, dug up a large quantity of a plant with its roots (which they took to be wild celery) to eat with their bread and butter for dinner. After wafhing it, while yet in the fields, they all three ate, or rather only tafted, of the roots.

As they were entering the town, one of them was feized with convulfions. The other two ran and fent a furgeon, who endeavoured firft to bleed, and then vomit him; but in vain, and he died prefently.

Ignorant of the caufe of their comrade's death, and of their own danger, they gave of thefe roots to eight other prifoners, who all ate fome of them with their dinner.

A few minutes after, the two who gathered the plants were feized in the fame manner as the firft; of which one died: The other was bled, and an emetic with great difficulty forced down, on account of his jaws being fet. This operating, he recovered; but was fome time much affected with a dizzinefs in his head, though not fick, or in the leaft difordered in his ftomach. The other eight, being bled and vomited immediately, were foon well.

This vegetable is fo extremely like celery, and therefore, as in the above cafe, fo apt to be miftaken for it, that it cannot be enough guarded againft by all who have a proper regard for themfelves. In the plate (fee Plate CCCXLVII.), X is the fhape of the root. *a*, The part cut off from the ftalk. *b*, A branch taken from the bottom of the ftalk, where the leaves are largeft. *c*, A top branch with the umbels of flowers. *d*, An anterior view of the flower in its natural fize. *e*, A pofterior view of the fame. *f*, The anterior appearance of the flower through a microfcope. *g*, The pofterior view of the fame. *h*, A view of the rudiments of the fruit after the decay of the flower. *i*, The fame magnified. A *, The fhape of a leaf of *celery*. B, a leaf of parfley.—Thefe two are printed, to prevent any unhappy miftake in eating the poifonous plant inftead of either. We have added to the figures of this dangerous plant thefe leaves of celery and parfley, which, as we have faid, it greatly refembles, in order to fhow our readers how careful they ought to be in cafe of an accident becaufe of this fimilarity.

OENKJE, in botany, a fpecies of iris. See IRIS.

OENOPTÆ, in Grecian antiquity, a kind of cenfors at Athens, who regulated entertainments, and took care that none drank too much, nor too little.

OENOS, in ornithology, the name ufed by authors for the ftock-dove, or wood-pigeon, called alfo by fome *vinago*, fomewhat larger than the common pigeon, but of the fame fhape and general colour. Its neck is of a fine changeable hue, as differently oppofed to the light; and its breaft, fhoulders, and wings, are of

Oenothera. a fine purplish hue, or red wine colour, from whence it has its name *vinago*. Its legs are red, and feathered a little below the joint.

OENOTHERA, TREE-PRIMROSE: A genus of the monogynia order, belonging to the octandria class of plants: and in the natural method ranking under the 17th order, *Calycanthemæ*. The calyx is quadrifid; the petals four; the capsule cylindric beneath; the seeds naked. There are seven species; the most remarkable of which are,

1. The biennis, or common biennial tree-primrose. It hath a long, thick, deeply striking root; crowned with many large, oval, spear-shaped, plane, spreading leaves; upright, thick, firm, rough, hairy stems, rising three or four feet high; garnished with long, narrow, lanceolate, close sitting leaves, irregularly; and at all the axillas, from the middle upwards, large bright yellow flowers.

2. Octovalvis, or octovalved, smooth, biennial tree-primrose, hath upright, firm, somewhat hairy stems, rising a yard high; oblong, spear-shaped, pointed, plane, smooth leaves; and at the axillas large bright yellow flowers.

3. The fruticosa, or shrubby, narrow-leaved perennial tree-primrose, hath long thick roots; upright under shrubby-like red stems, two or three feet high; spear shaped, lightly indented leaves: and at the axillas pedunculated clusters of yellow flowers, succeeded by pedicelloted, acute angled capsules.

4. The pumila, or low perennial tree-primrose, hath fibrous roots, crowned with many oval, spear-shaped, close fitting leaves: slender herbaceous stems from 10 to 12 inches long; garnished with spear-shaped, blunt, smooth leaves, having very short footstalks; and at the axillas smallish bright yellow flowers, succeeded by acute-angled capsules.

All these plants flower very profusely in June and July, coming out almost half the length of the stalks from the axillas; and as the stalk advances in stature new flowers are produced, succeeding those below; in which order the plants continue flowering from about midsummer till October: each flower is moderately large and conspicuous, consisting of four plane petals, which with the calyx forms a very long tube below, and spreading above, generally expand most towards the evening; and are succeeded by plenty of seed in autumn for propagation.

These plants are exotics from America; but are all very hardy, prosper in any common soil and situation, and have been long in the English gardens, especially the three first sorts; but the œnothera biennis is the most commonly known.

The first and second species are biennial, and the third and fourth are perennial in root.

They are proper to be employed as plants of ornament for embellishing the pleasure garden; they may be placed anywhere, and will effect a very agreeable variety three or four months with their plentiful blow of flowers.

The biennial kinds must be raised annually from seed, for they totally perish after they have flowered. But the perennials, once raised, continue for years by the root.

The propagation of all the sorts is by seed, and the perennial also by parting the roots.

OENOTRIA, an ancient name of Italy; so called from the *Oenotri*, (Virgil); inhabiting between Pæstum and Tarentum, (Ovid). Originally Arcadians, (Dionysius Halicarnassæus), who came under the conduct of Oenotrus son of Lycaon, 17 generations before the war of Troy, or 459 years, at 27 years each generation, and gave name to the people. Cato derives the name from *Oenotrus*, king of the Sabines and Etruscans; but Varro from *Oenotrus*, king of the Latins; and Servius from the Greek name for wine, for which Italy was famous; of which opinion is Strabo. Oenotria

OENOTRIDES (Strabo, Pliny), two small islands in the Tuscan sea, over against Velia, a town of Lucania, called *Pontia* and *Iscia*; now *Penza* and *Ischia*, on the coast of the Principato Citra, or to the west of Naples. So called from the *Oenotri*, an ancient people of Italy.

OESEL, an island of the Baltic sea, at the entrance of the gulf of Livonia. It is about 70 miles in length, and 50 in breadth, and contains 10 parishes. It is defended by the fortresses of Airensburg and Sonneburg. It lies between 22° and 24° of east longitude, and between 58° and 59° of north latitude.

OESOPHAGUS, in anatomy, the GULA, or *Gullet*, is a membranaceous canal, reaching from the fauces to the stomach, and conveying into it the food taken in at the mouth. See ANATOMY, N° 92.

Oestrus. OESTRUS, in zoology, a genus of insects belonging to the order of diptera. It has no mouth; but three punctures, without trunk or beak: Antennæ taper, proceeding from a lenticular joint. There are five species. Plate CCCL.

1. *Bovis, the breeze* or *gad fly*.—Thorax yellow, with a black transverse line between the wings: Abdomen tawny, with fine black transverse lines; last segment black: Wings white, with a brown transverse line, and three brown spots. Size of the large blue fly. Deposites its eggs under the skin on the backs of oxen, where the maggots are nourished the whole winter till the month of June; and plague the cattle so all the summer, that they are obliged to fly for refuge into the water, and dare not quit it the whole day.

2. *The hæmorrhoidalis*.—Body long, black, covered with tawny hair; middle of the thorax less hairy: wings immaculate; antennæ very short: Length half an inch. Deposites its eggs in the rectum of horses, and occasions great torments. See BOTTS.

3. *Ovis, the gray fly*.—Spotted with black; front pale yellow; legs brownish; wings with short black veins: length half an inch. Breeds in the frontal sinus of sheep; where the maggots hatched from the eggs, lodge the whole winter, vellicating the internal membranes, and often bringing on death.

5. *The nasalis*.—Body black: but the head, thorax, and abdomen, covered with pale red hair, except the first segment of the latter, which is covered with white hair; the wings immaculate. Breeds in the fauces of horses, entering by their nose.

5. *The tarandi*.—Thorax yellow; with a black line between the wings, which are immaculate: Abdomen tawny, last segment black. Infest the back of the rein deer, so as greatly to retard the breed. The rein deer of Lapland are obliged every year to fly to the Alpine mountains, to escape the pursuit of these

insects:

Plate CCCL.

Oestrus.
Sharp-tailed Oriole
Baltimore Oriole.
Ocolaxochitl.

insects: yet a fourth part of their number perish by them at two years old; the rest are emaciated, and have their skins spoiled. It is one of the most curious genera of insects. They are distinguished into several species, by reason of the different places wherein they deposite their eggs. Some, instructed by nature that their eggs cannot be hatched but under the skins of living creatures, such as bulls, cows, rein deer, stags, and camels, fix upon them at the instant of laying their eggs. From the hinder part of their body issues a whimble of wonderful structure. It is a scaly cylinder, composed of four tubes, which draw out like the pieces of a spying glass; the last is armed with three hook and is the gimblet with which the œstri bore through the tough hides of horned cattle. The animal seems to experience no pain from the puncture, unless the insect, plunging too deep, attacks some nervous fibre; in which case, the beast runs about, and becomes furious. The eggs being hatched, the grub feeds on the matter of the wound. The place of its abode forms upon the body of the quadrupeds a bunch sometimes above an inch high. When full grown, the larva breaks through the tumor, and slides down to the ground; for doing which it takes the cool of the morning, that it may neither be overpowered by the heat of the day, nor chilled by the cold of the night: it then digs itself a burrow, into which it retires. Its skin grows hard, and turns to a very solid shell. There it is transformed to a chrysalis, and afterwards to a winged insect. Nature has provided for every exigence: the shell wherein the œstrus is enclosed, is of so strong a texture that it could not make its way out, if at one of the ends there were not a small valve, fastened only by a very slight filament. The first push the œstrus makes, the door gives way and the prison opens. The insect wings its way to woods and places frequented by cattle.

OETA (anc. geog.), a mountain of Thessaly, extending from Thermopylæ westward to the Sinus Ambracius, and in some measure cutting at right angles the mountainous country stretching out between Parnassus to the south, and Pindus to the north. At Thermopylæ it is very rough and high, rising and ending in sharp and steep rocks, affording a narrow passage between it and the sea from Thessaly to Locris (Strabo), with two paths over it; the one above [illegible], very steep and high; the other through the country of the Ænianes, much easier and readier for travellers; by this it was that Leonidas was attacked in rear by the Persians (Pausanias). Here Hercules laid himself on the funeral pile (Silius Italicus, Ovid); the place thence called *Pyra* (Livy), who says, that the [illegible] mountains to the east are called *Oeta*; and hence the poets allege, that day, night, sun, and stars, arose from Oeta (Seneca, Statius, Silius Italicus, Catullus, Virgil's *Culex*)—circumstances which show the height of this mountain.

OETING, a town of Germany, in Upper Bavaria, under the jurisdiction of Buckhausen. It is divided into the upper and the lower town, and seated on the river Inn, eight miles west of Buckhausen. E. Long. 12. 47. N. Lat. 48. 0. There is a great resort of pilgrims to the old chapel.

Oeting, or *Oetingen*, a town of Germany, in the circle of Suabia, and capital of a county of the same name, seated on the river Wirnitz. E. Long. 10. 45. N. Lat. 48. 52.



Oeting, a county of Germany, in the circle of Suabia, bounded on the north and east by Franconia; on the south by the duchy of Neuburg; and on the west by that of Wirtemberg. It is about 40 miles from east to west, and 20 from north to south.

OFFA's-dyke, an intrenchment cast up by Offa, a Saxon king, to defend England against the incursions of the Welsh. It runs through Hertfordshire, Shropshire, Montgomeryshire, Denbighshire, and Flintshire.

OFFANTO, a river of Italy, in the kingdom of Naples. It rises in the Apennine mountains, in the Farther Principato; and passing by Conza, and Monte Verde, it afterwards separates the Capitanata from the Basilicata and the Terra-di-Bari, and then it falls into the gulf of Venice, near Salpe.

OFFENCE, in law, an act committed against the law, or omitted where the law requires it.

OFFERINGS. The Hebrews had several kinds of offerings, which they presented at the temple. Some were free-will offerings, and others were of obligation. The first fruits, the tenths, the sin offerings, were of obligation; the peace offerings, vows, offerings of wine, oil, bread, salt, and other things, which were made to the temple or to the ministers of the Lord, were offerings of devotion. The Hebrews called all offerings in general *corban*. But the offerings of bread, salt, fruits, and liquors, as wine and oil, which were presented to the temple, they called *mincha*. The sacrifices are not properly offerings, and are not commonly included under that name. See Corban and Sacrifice.

The offerings of grain, meal, bread, cakes, fruits, wine, salt, and oil, were common in the temple. Sometimes these offerings were alone, and sometimes they accompanied the sacrifices. Honey was never offered with the sacrifices; but it might be offered alone in the quality of first fruits. Now these were the rules that were observed in the presenting of those offerings, called in Hebrew *mincha*, or *korbon mincha*; in the Septuagint, *offerings of sacrifice*; and the same by St Jerome, *oblationem sacrificii*; but by our translators, *meat offerings* (Lev. ii. 1, &c.) There were five sorts of these offerings: 1. Fine flour or meal. 2. Cakes of several sorts, baked in an oven. 3. Cakes baked upon a plate. 4. Another sort of cakes, baked upon a gridiron, or plate with holes in it. 5. The first fruits of the new corn, which were offered either pure and without mixture, or roasted or parched in the ear, or out of the ear.

The cakes were kneaded with oil olive, or fried with oil in a pan, or only dipped in oil after they were baked. The bread offered to be presented upon the altar, was to be without leaven; for leaven was never offered upon the altar, nor with the sacrifices. But they might make presents of common bread to the priests and ministers of the temple. See Cake, &c.

The offerings now mentioned were appointed on account of the poorer sort, who could not go to the charge of sacrificing animals. And even those that offered living victims were not excused from giving meal, wine, and salt, which was to go along with the greater sacrifices. And also those that offered only oblations of bread or of meal, offered also oil, incense,

salt,

Offerings, Office. salt, and wine, which were in a manner the seasoning of it. The priest in waiting received the offerings from the hand of him that offered them; laid a part of them upon the altar, and reserved the rest for his own subsistence: that was his right as a minister of the Lord. Nothing was burnt quite up but the incense, of which the priest kept back nothing for his own share.

When an Israelite offered a loaf to the priest, or a whole cake, the priest broke the loaf or the cake into two parts, setting that part aside that he reserved to himself, and broke the other in crumbs; poured oil upon it, salt, wine; and incense, and spread the whole upon the fire of the altar. If these offerings be accompanied by an animal for a sacrifice, it was all thrown upon the victim, to be consumed along with it.

If these offerings were the ears of new corn, either of wheat or barley, these ears were parched at the fire or in the flame, and rubbed in the hand, and then offered to the priest in a vessel; over which he put oil, incense, wine, and salt, and then burnt it upon the altar, first having taken as much of it as of right belonged to himself.

The greatest part of these offerings were voluntary, and of pure devotion. But when an animal was offered in sacrifice, they were not at liberty to omit these offerings. Every thing was to be supplied that was to accompany the sacrifice, and which served as a seasoning to the victim. There are some cases in which the law requires only offerings of corn, or bread: for example, when they offered the first fruits of their harvest, whether they were offered solemnly by the whole nation, or by the devotion of private persons.

As to the quantity of meal, oil, wine, or salt, which was to go along with the sacrifices, we cannot easily see that the law had determined it. Generally the priest threw an handful of meal or crumbs upon the fire of the altar, with wine, oil, and salt in proportion, and all the incense. All the rest belonged to him, the quantity depended upon the liberality of the offerer. We observe in more places than one, that Moses appoints an assaron, or the tenth part of an ephah of meal, for those that had not wherewithal to offer the appointed sin offerings (Lev. v. 11. xiv. 21.) In the solemn offerings of the first fruits for the whole nation, they offered an entire sheaf of corn, a lamb of a year old, two tenths or two assarons of fine meal mixed with oil, and a quarter of an hin of wine for the libation. (Lev. xxiii. 10, 11, 12, &c.)

In the sacrifice of jealousy (Numb. v. 15.), when a jealous husband accused his wife of infidelity, the husband offered the tenth part of a satum of barley-meal, without oil or incense, because, it was a sacrifice of jealousy, to discover whether his wife was guilty or not.

The offerings of the fruits of the earth, of bread, of wine, oil, and salt, are the most ancient of any that have come to our knowledge. Cain offered to the Lord of the fruits of the earth, the first fruits of his labour (Gen. iv. 3, 4.) Abel offered the firstlings of his flocks, and of their fat. The heathen have nothing more ancient in their religion, that these sorts of offerings made to their gods. They offered clean wheat, flour, and bread.

OFFICE, a particular charge or trust, or a dignity attended with a public function, See HONOUR.—The word is primarily used in speaking of the offices of judicature and policy; as the office of secretary of state, the office of a sheriff, of a justice of peace, &c.

OFFICE also signifies a place or apartment appointed for officers to attend in, in order to discharge their respective duties and employments; as the secretary's office, ordnance office, excise office, signet office, paper office, pipe office, six clerks office, &c.

OFFICE, in architecture, denotes all the apartments appointed for the necessary occasions of a palace or great house; as kitchen, pantrics, confectionaries, &c.

OFFICE, in the canon law, is usual for a benefice, that has no jurisdiction annexed to it.

*Duty upon* OFFICES *and Pensions*, a branch of the king's extraordinary perpetual revenue, consisting in a payment of 1s. in the pound (over and above all other duties) out of all salaries, fees, and perquisites of offices and pensions payable by the crown. This highly popular taxation was imposed by stat. 31 Geo. II. c. 22. and is under the direction of the commissioners of the land tax.

Officers. OFFICER, a person possessed of a post or office. See the preceding article.

The great officers of the crown, or state, are, The lord high steward, the lord high chancellor, the lord high treasurer, the lord president of the council, the lord privy seal, the lord chamberlain, the lord high constable, and the earl marshal; each of which see under its proper article.

*Non-commissioned* OFFICERS, are serjeant majors, quarter master serjeants, serjeants, corporals, drum and fife majors; who are nominated by their respective captains, and appointed by the commanding officers of regiments, and by them reduced without a court martial.

*Orderly non-commissioned* OFFICERS, are those who are orderly, or on duty for that week; who, on hearing the drum beat for orders, are to repair to the place appointed to receive them, and to take down in writing, in the orderly book, what is dictated by the adjutant, or serjeant major: they are then immediately to show these orders to the officers of the company, and afterwards warn the men for duty.

*Flag* OFFICERS. See *Flag Officers*, and ADMIRALS.

*Commission* OFFICERS, are such as are appointed by the king's commission. Such are all from the general to the cornet and ensign inclusive. They are thus called in contradistinction to commissioned officers. See *Non-commissioned* OFFICERS.

*General* OFFICERS, are those whose command is not limited to a single company, troop, or regiment; but extends to a body of forces composed of several regiments: such are the general, lieutenant general, major general, and brigadier.

OFFICERS *of the Household*. See the article HOUSEHOLD.

*Staff* OFFICERS, are such as, in the king's presence, bear a white staff or wand; and at other times, on their going abroad, have it carried before them by a footman bare-headed: such are the lord steward, lord chamberlain, lord treasurer, &c.

The white staff is taken for a commission; and, at the king's death, each of these officers breaks his staff over the herse made for the king's body, and by this means

means lays down his commission, and discharges all his inferior officers.

*Subaltern* OFFICERS, are all who administer justice in the name of subjects; as those who act under the earl marshal, admiral, &c. In the army, the subaltern officers are the lieutenants, cornets, ensigns, serjeants, and corporals.

OFFICIAL, in the canon law, an ecclesiastical judge, appointed by a bishop, chapter, abbot, &c. with charge of the spiritual jurisdiction of the diocese.

OFFICIAL, is also a deputy appointed by an archdeacon as his assistant, who sits as judge in the archdeacon's court.

OFFICINAL, in pharmacy, an appellation given to such medicines, whether simple or compound, as are required to be constantly kept in the apothecaries shops. The *officinal simples* are appointed, among us, by the College of Physicians; and the manner of making the compositions directed in their dispensatory. See PHARMACY.

OFFING, or OFFIN, in the sea language, that part of the sea a good distance from shore, where there is deep water, and no need of a pilot to conduct the ship: thus, if a ship from shore be seen sailing out to seaward, they say, *she stands for the offing;* and if a ship, having the shore near her, have another a good way without her, or towards the sea, they say, *that ship is in the offing.*

OFF-SETS, in gardening, are the young shoots that spring from the roots of plants; which being carefully separated, and planted in a proper soil, serve to propagate the species.

OFF-SETS, in surveying, are perpendiculars let fall, and measuring from the stationary lines to the hedge, fence, or extremity of an enclosure.

OGEE, or O. G. in architecture, a moulding consisting of two members, the one concave and the other convex; or of a round and hollow, like an S. See ARCHITECTURE.

OGHAMS, a particular kind of steganography, or writing in cypher practised by the Irish; of which there were three kinds: The first was composed of certain lines and marks, which derived their power from their situation and position, as they stand in relation to one principal line, over or under which they are placed, or through which they are drawn; the principal line is horizontal, and serveth for a rule or guide, whose upper part is called the left, and the under side the right; above, under, and through which line, the characters or marks are drawn, which stand in the place of vowels, consonants, diphthongs, and triphthongs. Some authors have doubted the existence of this species of writing in cypher, called *Ogham* among the Irish: but these doubts are perhaps ill founded; for several MSS. in this character still exist, from which Mr Astle has given a plate of them.

OGILBY (John), an eminent writer, was born in or near Edinburgh, about the 17th of November 1600. His father having spent his estate, and being prisoner in the King's Bench for debt, could contribute but little to his education; however, he obtained some knowledge in the Latin grammar, and afterwards so much money as to procure his father's discharge from prison, and to bind himself an apprentice to a dancing-master in London; when, by his dexterity in his profession, and his complaisant behaviour to his master's scholars, he obtained money to buy out the remainder of his time, and set up for himself. But being afterwards appointed to dance in the duke of Buckingham's great mask, he by a false step strained a vein in the inside of his leg, which occasioned his being ever after somewhat lame. When Thomas earl of Strafford was made lord-lieutenant of Ireland, he was entertained as a dancing master in his family, and made one of the earl's troop of guards; at which time he composed a humorous piece called the *Character of a Trooper.* He was soon after appointed master of the revels in Ireland, and built a theatre at Dublin. About the time of the conclusion of the war in England, he left Ireland; and, being shipwrecked, came to London in a necessitous condition; but soon after walked to Cambridge, where, being assisted by several scholars, he became so complete a master of the Latin tongue, that in 1649 he published a translation of Virgil. He soon after learned Greek; and in 1660 published, in folio, a translation of Homer's Iliad, with Annotations. About two years after he went into Ireland, where he was made master of the revels by patent. He then built another theatre in Dublin, which cost him about 1000l. He published at London, in folio, a translation of Homer's Odyssey, with Annotations; and afterwards wrote two heroic poems, entitled the *Ephesian Matron,* and the *Roman Slave.* He next composed the Carolics, an epic poem, in 12 books, in honour of King Charles I. but this was entirely lost in the fire of London; when Mr Ogilby's house in White Friars was burnt down, and his whole fortune, except to the value of five pounds, destroyed. He, however, soon procured his house to be rebuilt, set up a printing-office within it, was appointed his majesty's cosmographer and geographic printer, and printed several great works, translated or collected by himself and his assistants, particularly his Atlas. He died in 1676.



OGIVE, in architecture, an arch or branch of a Gothic vault; which, instead of being circular, passes diagonally from one angle to another, and forms a cross with the other arches. The middle, where the ogives cross each other, is called the *key;* being cut in form of a rose, or a *cul de lampe.* The members or mouldings of the ogives are called *nerves, branches,* or *reins;* and the arches which separate the ogives, *double arches.*

OGYGES, king of the Thebans, or, according to others, of Ogygia and Actæ, afterwards called *Bœotia and Attica.* He is recorded to have been the first founder of Thebes and Eleusis. The famous deluge happened in his time, in which some say he perished with all his subjects, 1796 B. C.

OGYGIA (Homer), the island of Calypso; placed by Pliny in the Sinus Scylaceus, in the Ionian sea, opposite to the promontory Lacinium; by Mela in the strait of Sicily, calling it *Ææa;* which others place at the promontory Circeium, and call it the island of *Circe.*

OGYGIA, the ancient name of Thebes in Bœotia: so called from Ogyges, an ancient king, under whom happened

happened a great deluge, 1020 years before the first Olympiad.

OHIO, a river of North America, called by the French the *Beautiful River*, has its source between the Allegany mountains and the lake Erie; and running south-west through a most delightful country, and also receiving many smaller rivers in its passage, at length falls into the Mississippi, in about 37 degrees of latitude. The French had several forts on and near it; but the whole country through which it flows was ceded by the peace of 1763 to the British.

OHETEROA, one of the South sea islands lately discovered, is situated in W. Long. 150. 47. S. Lat. 22. 27. It is neither fertile nor populous; nor has it any harbour or anchorage fit for shipping, and the disposition of the people is hostile to such as visit them.

OIL, in natural history, an unctuous inflammable substance, drawn from several natural bodies, as animal and vegetable substances.

Animal oils are their fats, which are originally vegetable oils: all animal substances yield them, together with their volatile salts, in distillation.

Vegetable oils are obtained by expression, infusion, and distillation.

The oils by expression are obtained from the seed, leaves, fruit, and bark of plants; thus, the seed of mustard, and of the sun flower, almonds, nuts, beech mast, &c. afford a copious oil by expression; and the leaves of rosemary, mint, rue, wormwood, thyme, sage, &c. the berries of juniper, olives, Indian cloves, nutmeg, mace, &c. the barks of cinnamon, sassafras, and clove, yield a considerable proportion of essential oil by distillation.

The method of procuring oils by expression is very simple: thus, if either sweet or bitter almonds, that are fresh, be pounded in a mortar, the oil may be forced out with a press, not heated: and in the same manner should the oil be pressed from linseed and mustard. The avoiding the use of heat, in preparing these oils intended for internal medicinal use, is of great importance, as heat gives them a very prejudicial rancidness.

This method holds of all those vegetable matters that contain a copious oil, in a loose manner, or in certain cavities or receptacles; the sides whereof being broken, or squeezed, makes them let go the oil they contain: and thus the zest or oil of lemon peel, orange peel, citron peel, &c. may be readily obtained by pressure, without the use of fire. But how far this method of obtaining oils may be applied to advantage, seems not hitherto considered. It has been commonly applied to olives, almonds, linseed, rape seed, beech mast, ben-nut, walnuts, bay-berries, mace, nutmeg, &c. but not, that we know of, to juniper berries, cashew nuts, Indian cloves, pine apples, and many other substances that might be enumerated, both of foreign and domestic growth. It has, however, been of late successfully applied to mustard seed, so as to extract a curious gold-coloured oil, leaving a cake behind, fit for making the common table mustard.

Certain dry matters, as well as moist ones, may be made to afford oils by expression, by grinding them into a meal, which being suspended to receive the vapour of boiling water, will thus be moistened so as to afford an oil in the same manner as almonds; and thus an oil may be procured from linseed, hemp seed, lettuce seed, white poppy seed, &c.

As to the treatment of oils obtained by expression, they should be suffered to depurate themselves by standing in a moderately cool place, to separate from their water, and deposite their fæces; from both which they ought to be carefully freed. And if they are not thus rendered sufficiently pure, they may be washed well with fresh water, then thoroughly separated from it again by the separating glass, whereby they will be rendered bright and clear.

The next class of oils are those made by infusion, or decoction, wherein the virtues of some herb or flower are drawn out in the oil; as the oil of roses, chamomile, hypericum, alder, &c. However, these require to be differently treated: thus, for the scented flowers, particularly roses, insolation does best; because much boiling would exhale their more fragrant parts: but oils impregnated with green herbs, as those of chamomile and alder, require long boiling, before they receive the green colour desired. And, in general, no oils will bear to be boiled any longer than there remains some aqueous humidity, without turning black.

There are many compound oils prepared in the same manner, viz. by boiling and insolation, and then straining off the oil for use.

The same contrivance has likewise its use in making essences for the service of the perfumer; not only where essential oils cannot be well obtained in sufficient quantities, but also where they are too dear. The essential oil of jessamine flowers, honeysuckles, sweet briar, damask roses, lilies of the valley, &c. are either extremely dear, or scarcely obtainable by distillation; and, in some of them, the odorous matter is so subtle, as almost to be lost in the operation. But if these flowers be barely infused in fine oil of nuts, or oil of ben, drawn without heat, and kept in a cool place, their subtile odorous matter will thus pass into the oil, and richly impregnate it with their flavour. And these essences may be rendered still more perfect by straining off the oil at first put on, and letting it stand again, without heat, upon fresh flowers; repeating the operation twice or thrice.

Oils or fats may likewise be obtained, by boiling and expression, from certain animal substances; for the membranes which contain the fat, being chopped small, and set in a pan over the fire, become fit for the canvas bags, and, by pressure, afford a large quantity of fat; as we see in the art of chandlery, which thus extracting the oily matter, leaves a cake behind, commonly called *graves*.

As to the essential oils of vegetables, they are obtained by distillation with an alembic and a large refrigeratory. Water must be added to the materials in sufficient quantity, to prevent their burning; and they should be macerated or digested in that water, a little time before distillation. The oil comes over with the water; and either swims on the top, or sinks to the bottom, according as it is specifically heavier or lighter than water.

This process is applicable to the distilling of the essential oils from flowers, leaves, barks, roots, woods,

Oil.

gums, and balfams, with a flight alteration of circumftances, as by longer digeftion, brifker diftillation, &c. according to the tenacity and hardnefs of the fubject, the ponderofity of the oil, &c.

Effential oils may be divided into two claffes, according to their different fpecific gravities; fome floating upon water, and others readily finking to the bottom. Thus, the effential oils of cloves, cinnamon, and faffafras, readily fink, whereas thofe of lavender, marjoram, mint, &c. fwim, in water: the lighteft of thefe effential oils is, perhaps, that of citron peel, which even floats in fpirit of wine; and the heavieft feems to be oil of faffafras.

For obtaining the full quantity of the more ponderous oils from cinnamon, cloves, faffafras, &c. it is proper to reduce the fubjects to powder; to digeft this powder for fome days in a warm place, with thrice its quantity of foft river water, made very faline by the addition of fea falt, or fharp with oil of vitriol; to ufe the ftrained decoction, or liquor left behind in the ftill, inftead of common water, for frefh digeftion; to ufe for the fame purpofe the water of the fecond running, after being cleared of its oil; not to diftil too large a quantity of thefe fubjects at once; to leave a confiderable part of the ftill, or about one fourth, empty; to ufe a brifk fire, or a ftrong boiling heat, at the firft, but to flacken it afterwards; to have a low ftill head, with a proper internal ledge and current leading to the nofe of the worm; and, finally, to cohabate the water, or pour back the liquor of the fecond running upon the matter in the ftill, repeating this once or twice.

The directions here laid down for obtaining the ponderous oils to advantage, are eafily transferred to the obtaining of the lighter; fo that we need not dwell particularly upon them.

Many of the effential oils being dear, it is a very common practice to adulterate or debafe them feveral ways, fo as to render them cheaper both to the feller and the buyer. Thefe feveral ways feem reducible to three general kinds, each of which has its proper method of detection, viz. 1. With expreffed oils. 2. With alcohol. And, 3. With cheaper effential oils.

If an effential oil be adulterated with an expreffed oil, it is eafy to difcover the fraud; by adding a little fpirit of wine to a few drops of the fufpected effential oil, and fhaking them together; for the fpirit will diffolve all the oil that is effential, or procured by diftillation, and leave all the expreffed oil that was mixed with it, untouched.

If an effential oil be adulterated with alkohol, or rectified fpirit of wine, it may be done in any proportion, up to that of an equal quantity, without being eafily difcoverable either by the fmell or tafte: the way to difcover this fraud, is to put a few drops of the oil into a glafs of fair water; and if the oil be adulterated with fpirit, the water will immediately turn milky, and, by continuing to fhake the glafs, the whole quantity of fpirit will be abforbed by the water, and leave the oil pure at top.

Finally, If an effential oil be adulterated by a cheaper effential oil, this is commonly done very artfully: the method is to put fir wood, turpentine, or oil of turpentine, into the ftill, along with the herbs to be diftilled for their oil, fuch as rofemary, lavender, origanum, &c. and by this means the oil of turpentine diftilled from thefe ingredients comes over in great quantity, and intimately blended with the oil of the genuine ingredient. The oils thus adulterated always difcover themfelves in time, by their own flavour being overpowered by the turpentine fmell: but the ready way to detect the fraud, is to drench a piece of rag, or paper, in the oil, and hold it before the fire; for thus the grateful flavour of the plant will fly off, and leave the naked turpentine fcent behind.

Oil ‖ Old.

The virtues of oils, being the fame with thofe of the fubftances from whence they are obtained, may be learned under their feveral articles, to which we refer.

We have this account of different oils in the ifland of Madagafcar in the Univerfal Hiftory.

Oils are of different forts, the moft common are thofe of menach-tanhetanhe, menach fignifying oil, menachil, menach-chouivau, menach-mafoutra, menach-vourave, menach-apocapouc, menach-vintang, and menach-arame. Menach-tanhetanhe is drawn from a particular plant, called, in the language of the country, *tanhetanhe*, and known in Europe by the name of *palma Chrifti*, or *ricinus*. Menachil is an oil from the feed of fefame, which they call *voancaze*; a great quantity whereof is made in the valley of Amboule. Menach-chouivau is drawn from a fruit of the fize of an almond, extremely good in liquors or meats. Menach-mafoutra is drawn from nuts, the fruit of the tree which produces dragon's blood. Menach-vourave is drawn from a fruit named *fontfi*. Menach-apocapouc is fqueezed from the fruit apocapouc, extremely poifonous. Menach-vintang is an oil from large acorns, or maft. Menach-arame is drawn from nuts, the fruit of the tree from which the gum tacamahaca is produced.

*Rock Oil*. See PETROLEUM.

*Effential Oil of Rofes*. See ROSES.

*Method of Purifying Rancid* OILS. See CHEMISTRY, N° 1431.

OINTMENT, in pharmacy. See UNGUENT.

OKEHAM, the capital of Rutlandfhire, in England, feated in a rich and pleafant valley, called the *vale of Catmus*. It is pretty well built, has a good church, a free-fchool, and an hofpital. W. Long. 0. 45. N. Lat. 52. 40.

OKINGHAM, OCKINGHAM, or *Woxingham*, a large town of Berkfhire, in England, noted for the manufacture of filk ftockings. W. Long. 0. 50. N. Lat. 51. 26.

OLAUS MAGNUS. See MAGNUS.

OKRA. See HIBISCUS.

OLAX, in botany: A genus of the monogynia order, belonging to the triandria clafs of plants; and in the natural method ranking with thofe of which the order is doubtful. The calyx is entire; the corolla funnel-fhaped and trifid; the nectarium tetraphyllous.

OLD AGE. See LONGEVITY. Many methods have been propofed for lengthening life, and rendering old age comfortable. Cornaro's Treatife on this fubject is known to every body, and needs not be quoted. To fome of our readers the following fet of refolutions

refolutions will perhaps be new, and may certainly be ufeful.

The old men fhould refolve, except the reafons for a change be invincible, to live and to die in the public profeffion of the religion in which they were born and bred. To avoid all profane talk and intricate debates on facred topics. To endeavour to get the better of the intrufions of indolence of mind and body, thofe certain harbingers of enfeebling age. Rather to wear out, than to ruft out. To rife early, and as often as poffible to go to bed before midnight. Not to nod in company, nor to indulge repofe too frequently on the couch in the day. To wafte as little of life in fleep as may be, for we fhall have enough in the grave. Not to give up walking; nor to ride on horfeback to fatigue. Experience, and a late medical opinion, determine to ride five miles every day: Nothing contributes more to the prefervation of appetite, and the prolongation of life. Cheyne's direction to the valetudinary, "to make exercife a part of their religion," to be religioufly obferved. To continue the practice of reading, purfued for more than fifty years, in books on all fubjects; for variety is the falt of the mind as well as of life. Other people's thoughts, like the beft converfation of one's companions, are generally better and more agreeable than one's own. Frequently to think over the virtues of one's acquaintance, old and new. To admit every cheerful ray of funfhine on the imagination. To avoid retrofpection on a paft friendfhip, which had much of love in it; for memory often comes when fhe is not invited. To try to think more of the living and lefs of the dead; for the dead belong to a world of their own. To live within one's income, be it large or little. Not to let paffion of any fort run away with the underftanding. Not to encourage romantic hopes nor fears. Not to drive away hope, the fovereign balm of life, though he is the greateft of all flatterers. Not to be under the dominion of fuperftition or enthufiafm. Not wilfully to undertake any thing for which the nerves of the mind or the body are not ftrong enough. Not to run the race of competition, or to be in another's way. To avoid being joftled too much in the ftreet, being overcome by the noife of the carriages, and not to be carried even by curiofity itfelf into a large crowd. To ftrive to embody that dignified fentiment, "to write injuries in duft, but kindneffes in marble." Not to give the reins to conftitutional impatience, for it is apt to hurry on the firft expreffions into the indecency of fwearing. To recollect, that he who can keep his own temper may be mafter of another's. If one cannot be a ftoic, in bearing and forbearing, on every trying occafion, yet it may not be impoffible to pull the check-ftring againft the morofenefs of fpleen or the impetuofity of peevifhnefs. Anger is a fhort madnefs. Not to fall in love, now on the precipice of threefcore, nor expect to be fallen in love with. A connexion between fummer and winter is an improper one. Love, like fire, is a good fervant, but a bad mafter. Love is death, when the animal fpirits are gone. To contrive to have as few vacant hours upon one's hands as poffible, that idlenefs, the mother of crimes and vices, may not pay its vifit. To be always doing of fomething, and to have fomething to do. To fill up one's time, and to have a good deal to fill up: for time is the materials that life is made of. If one is not able by fituation, or through the neceffity of raifing the fupplies within the year, or by habit (for virtue itfelf is but habit), to do much oftentatious good, yet do as little harm as poffible. To make the beft and the moft of every thing. Not to indulge too much in the luxury of the table, nor yet to underlive the conftitution. The gout, rheumatifm, and dropfy, in the language of the Spectator, feem to be hovering over the difhes. Wine, the great purveyor of pleafure, and the fecond in rank among the fenfes, offers his fervice, when love takes his leave. It is natural to catch hold of every help, when the fpirits begin to droop. Love and wine are good cordials, but are not proper for the beverage of common ufe. Refolve not to go to bed on a full meal. A light fupper and a good confcience are the beft receipts for a good night's reft, and the parents of undifturbing dreams. Not to be enervated by the flatulency of tea. Let the fecond or third morning's thought be to confider of the employment for the day; and one of the laft at night to inquire what has been done in the courfe of it. Not to let one's tongue run at the expence of truth. Not to be too communicative nor unreferved. A clofe tongue, with an open countenance, are the fafeft paffports through the journey of the world. To correct the error of too much talking, and reftrain the narrativenefs of the approaching climacteric. To take the good-natured fide in converfation. However, not to praife every body, for that is to praife nobody. Not to be inquifitive, and eager to know fecrets, nor be thought to have a head full of other people's affairs. Not to make an enemy, nor to lofe a friend. To aim at the efteem of the public, and to leave a good name behind. Not to be fingular in drefs, in behaviour, in notions, or expreffions of one's thoughts. Never to give bad advice, and to ftrive not to fet a bad example. Seldom to give advice till afked, for it appears like giving fomething that is fuperfluous to one's felf. Not to like or diflike too much at firft fight. Not to wonder, for all wonder is ignorance that poffeffion falls fhort of expectation. The longing of twenty years may be difappointed in the unanfwered gratification of a fingle hour. Whilft we are wifhing, we fee the beft fide; after we have taken poffeffion, the worft. Refolve to attend to the arguments on both fides, and to hear every body againft every body. The mind ought not to be made up, but upon the beft evidence. To be affectionate to relations, which is a kind of felflove, in preference to all other acquaintance. But not to omit paying the commanding refpect to merit, which is fuperior to all the accidental chains of kindred. Not to debilitate the mind by new and future compofitions. Like the fpider, it may fpin itfelf to death. The mind, like the field, muft have its fallow feafon. The leifure of the pen has created honourable acquaintance, and pleafed all it has wifhed to pleafe. To refolve not to be too free of promifes, for performances are fometimes very difficult things. Not to be too much alone, nor to read, nor meditate, or talk too much on points that may awaken tender fenfations, and be too pathetic for the foul. To enjoy the prefent, not to be made too unhappy by reflection on the paft, not to be oppreffed by invincible gloom on the

the future. To give and receive comfort, those necessary alms to a distressed mind. To be constantly thankful to Providence for the plenty hitherto possessed, which has preserved one from the dependence on party, persons, and opinions, and kept one out of debt. The appearance of a happy situation, and opportunities of tasting many worldly felicities (for content has seldom perverted itself into discontent), has induced many to conclude, that one must be pleased with one's lot in life; and it occasions many to look with the eye of innocent envy. To resolve more than ever to shun every public station and responsibility of conduct. To be satisfied with being master of one's self, one's habits, now a second nature, and one's time. Determined not to solicit, unless trampled upon by fortune, to live and die in the harness of trade, or a profession. To take care that pity (humanity is not here meant) does not find out one in the endurance of any calamity. When pity is within call, contempt is not far off. Not to wish to have a greater hold of life, nor to quit that hold. The possible tenure of existence is of too short possession for the long night that is to succeed: therefore not a moment to be lost. Not to lose sight, even for a single day, of these good and proverbial doctors—diet—merryman—and quiet. Resolved to remember and to recommend, towards tranquillity and longevity, the three oral maxims of Sir Hans Sloane—"Never to quarrel with one's self—one's wife—or one's prince." Lastly, Not to put one's self too much in the power of the elements, those great enemies to the human frame; namely, the sun—the wind—the rain—and the night air.

*Old Man of the Mountain.* See Assassins.

OLDCASTLE (Sir John), called the *Good Lord Cobham*, was born in the reign of Edward III. and was the first author as well as the first martyr among the English nobility: he obtained his peerage by marrying the heiress of that Lord Cobham who with so much virtue and patriotism opposed the tyranny of Richard II. By his means the famous statute against provisors was revived, and guarded against by severer penalties; he was one of the leaders of the reforming party; was at great expence in procuring and dispersing copies of Wickliffe's writings among the people, as well as by maintaining a number of his disciples as itinerant preachers. In the reign of Henry V. he was accused of heresy; the growth of which was attributed to his influence. Being a domestic in the king's court, the king delayed his prosecution that he might reason with him himself; but not being able to reclaim him to the church of Rome, he in great displeasure resigned him to its censure. He was apprehended and condemned for heresy; but escaping from the Tower, lay concealed for four years in Wales, until the rumour of a pretended conspiracy was raised against him, and a price set upon his head: he was at last seized, and executed in St Giles's Fields; being hung alive in chains upon a gallows, and burned by a fire placed underneath. He wrote "Twelve Conclusions, addressed to the Parliament of England."

OLDENBURG, a title of the royal house of Denmark. The origin of this illustrious family, we are told, is this:—

On the death of Christopher king of Denmark, &c. in 1448, without issue, there was a great contest about the succession; and a variety of factions were raised, particularly in Sweden and Norway, for the promotion of different persons; and various animosities and numerous discords were excited by the several parties, in order each to obtain their own ends.



As soon as these intrigues were known in Denmark, the senate resolved to proceed to the election of a king; for it did not appear expedient to commit the government of affairs to the queen dowager at a time when they had every thing to fear from the two neighbouring crowns. At this time a lord of great weight, property, and ambition, sought the queen in marriage, the more easily to pave his way to the throne. This is a fact mentioned by Pontanus and Meursius, though neither takes notice of his name. But as for a great number of years there was no precedent for electing a king out of the body of nobility, though agreeable to law, the queen entered into the views of the senate, and declared she would give her hand to no prince who should not be judged deserving of the crown by the supreme council of the nation.

The advantages which would have accrued from annexing the duchy of Sleswick and Holstein to the crown, made the senate first cast their eye on Adolphus. This matter required no long deliberation; all saw the conveniences resulting from such an union, and gave their assent. Immediately an embassy was despatched with the offer to Adolphus; but that prince consulting the good of his subjects, whose interest would have been absorbed in the superior weight of Denmark, declined it, with a moderation and disinterestedness, altogether uncommon among princes. However, that he might not be wanting in respect to the senate, he proposed to them his nephew Christian, second son to Theodoric, count of Oldenburg, a prince bred up at the court of Adolphus from his infancy. The proposition was so agreeable to the senate, that, without loss of time, the ambassadors were sent to Theodoric, to demand either of his sons he should pitch upon for their king. Theodoric's answer to the ambassadors was remarkable: "I have three sons, says he, of very opposite qualities. One is passionately fond of pleasure and women; another breathes nothing but war, without regarding the justice of the cause; but the third is moderate in his disposition, prefers peace to the din of arms, yet stands unrivalled in valour, generosity, and magnanimity." He said he painted these characters for the senate's information, desiring they would choose which of the young princes they believed would render the kingdom happiest. It was a matter which would admit of no hesitation: with one voice the senate declared for that prince whose panegyric the father had so warmly drawn; and under these happy auspices commenced the origin of the grandeur of the house of Oldenburg, at this day seated on the throne of Denmark.

Oldenburg (Henry), a learned German gentleman in the 17th century, was descended from the noble family of his name, who were earls of the county of Oldenburg, in the north part of Westphalia, for many generations. He was born in the duchy of Bremen in the Lower Saxony; and during the long English parliament in King Charles I.'s time, was appointed consul for his countrymen, at London, after the usurpation of Cromwell: but being discharged of that

that employ, he was made tutor to the lord Henry O'Bryan, an Irish nobleman, whom he attended to the university of Oxford, where he was admitted to study in the Bodleian library in the beginning of the year 1656. He was afterwards tutor to William lord Cavendish, and was acquainted with Milton the poet. During his residence at Oxford, he became also acquainted with the members of that body there which gave birth to the Royal Society; and upon the foundation of this latter, he was elected fellow; and when the society found it necessary to have two secretaries, he was chosen assistant secretary to Dr Wilkins. He applied himself with extraordinary diligence to the business of his office, and began the publication of the Philosophical Transactions with N° I. in 1664. In order to discharge this task with greater credit to himself and the society, he held a correspondence with more than seventy learned persons, and others, upon a vast variety of subjects, in different parts of the world. This fatigue would have been insupportable, had not he, as he told Dr Lister, managed it so as to make one letter answer another; and that to be always fresh, he never read a letter before he had pen, ink, and paper, ready to answer it forthwith; so that the multitude of his letters cloyed him not, nor ever lay upon his hands. Among others, he was a constant correspondent of Mr Robert Boyle, with whom he had a very intimate friendship; and he translated several of that ingenious gentleman's works into Latin.

Mr Oldenburg continued to publish the Transactions, as before, to N°XXXVI. June 25. 1677. After which the publication was discontinued till the January following, when it was again resumed by his successor in the secretary's office, Mr Nehemiah Grew, who carried it on till the end of February 1678. Our author dying at his house at Charleton, near Greenwich in Kent, in the month of August that year, was interred there.

OLDENLANDIA, in botany: A genus of the tetrandria monogynia class. Its characters are these: The empalement of the flower is permanent, sitting upon the germen; the flower has four oval petals, which spread open, and four stamina, terminated by small summits; it hath a roundish germen, situated under the flower, crowned by an indented stigma; the germen afterwards turns to a globular capsule, with two cells filled with small seeds. We have but one species of this plant in the English gardens: but Linnæus enumerates six.

OLDHAM (John), an eminent English poet in the 17th century, son of a Nonconformist minister, was educated under his father, and then sent to Edmund-hall in Oxford. He became usher to the free-school at Croydon in Surry; where he received a visit from the earls of Rochester and Dorset, Sir Charles Sedley, and other persons of distinction, merely upon the reputation of some verses of his which they had seen in manuscript. He was tutor to several gentlemen's sons successively; and having saved a small sum of money, came to London, and became a perfect votary to the bottle, being an agreeable companion. He was quickly found out here by the noblemen who had visited him at Croydon, who brought him acquainted with Mr Dryden. He lived mostly with the earl of Kingston at Holme-Pierpoint in Nottinghamshire, where he died of the smallpox in 1683, in the 30th year of his age. His acquaintance with learned authors appears by his satires against the Jesuits, in which there is as much learning as wit discovered. Mr Dryden esteemed him highly. His works are printed in 2 vols. 12mo. They chiefly consist of satires, odes, translations, paraphrases of Horace and other authors, elegiac verses, imitations, parodies, familiar epistles, &c.

OLD-HEAD, situated in the county of Cork, and province of Munster, four miles south of Kinsale, in the barony of Courcies, Ireland: it is a promontory, running far into the sea, on which is a lighthouse for the convenience of shipping. A mile from its extremity is an ancient castle of the lords of Kinsale, built from one side of the isthmus to the other, which defended all the lands towards the head: this place was formerly called *Duncearma*, and was the old seat of the Irish kings. The isthmus, by the working of the sea, was quite penetrated through, so as to form a stupendous arch, under which boats might pass from one bay to the other. Among the rocks of this coast there are aviaries of good hawks; also the sea eagles or ospreys build their nests and breed them.

OLDMIXON (John), was descended from an ancient family in Somersetshire: he was a violent party-writer and malevolent critic, who would scarcely have been remembered, if Pope, in resentment of his abuse, had not condemned him to immortality in his Dunciad. His party-writings procured him a place in the revenue at Liverpool, where he died at an advanced age in the year 1745. Besides his fugitive temporary pieces, he wrote a History of the Stuarts, in folio; a Critical History of England, 2 vols. 8vo; a volume of Poems, some dramatic pieces, &c.; none of them worthy of notice, his principal talent being that of falsifying history.

Old-wife, or *Wrasse*. See Labrus.

Old-wife *Fish*. See Balistes.

Old-woman's island, a narrow slip of land, about two miles long, separated from Bombay in the East Indies by an arm of the sea, which, however, is passable at low water. It terminates at one extremity in a small eminence, on which a look-out house is kept for vessels. Near the middle are three tombs kept constantly white, as land-marks into the harbour. From the end of the island a dangerous ledge of rocks shoots forth, which are not very easily cleared. It produces only pasture for a few cattle.

OLEA, in botany, the *olive-tree*: A genus of the monogynia order, belonging to the diandria class of plants; and in the natural method ranking under the 44th order, *Sepiariæ*. The corolla is quadrifid, with the segments nearly ovate. The fruit is a monospermous plum.

There are three species of the olea. 1. The *Europea*, or common olive tree, rises with upright solid stems, branching numerously on every side, 20 or 30 feet high; spear-shaped, stiff, opposite leaves, two or three inches long, and half an inch or more broad; and at the axillas small clusters of white flowers, succeeded by oval fruit.

This species is the principal sort cultivated for its fruit; the varieties of which are numerous, varying in colour, and quality.

Olea. It is a native of the southern warm parts of Europe, and is cultivated in great quantities in the south of France, Italy, and Portugal, for the fruit to make the olive oil, which is in so great repute, and is transported to all parts, to the great advantage of those countries where the trees grow in the open ground: the green fruit is also in much esteem for pickling, of which we may see plenty in the shops.

2. The *capensis*, or cape box-leaved olive, rises with shrubby stems, branching numerously from the bottom, six or seven feet high; small, oval, thick, stiff, shining leaves; and at the axillas small clusters of whitish flowers, succeeded by small fruit of inferior value.

3. *Olea odoratissima* (Indian name, *quesa;* Japanese name, *Skio Ran, it: Sju Ran*) is thus described by Thunberg, *bulbis fibrosis, foliis ensiformibus, sessilibus, floribus pendulis.* (See Plate CCCXLIX.) The flower of the olea odoratissima is by some said to give the fine flavour to the green tea; but Thunberg attributes the said flavour to the *Cemellie seserque.*

Olive trees are easily propagated by shoots; which, when care has been taken to ingraft them properly, bear fruit in the space of eight or ten years. Those kinds of olive trees which produce the purest oil, and bear the greatest quantity of fruit, are ingrafted on the stocks of inferior kinds.

Different names are assigned by the French to the different varieties of the olive tree; and of these they reckon 19, whilst in Florence are cultivated no fewer than 32.

Olive shoots are ingrafted when in flower. If the operation has been delayed, and the tree bears fruit, it is thought sufficient to take off a ring of bark, two fingers breadth in extent, above the highest graff. In that case the branches do not decay the first year; they afford nourishment to the fruit, and are not lopped off till the following spring. Olive trees are commonly planted in the form of a quincunx, and in rows at a considerable distance from one another. Between the rows is is usual to plant vines, or to sow some kind of grain. It is observed, that olives, like many other fruit trees, bear well only once in two years. The whole art of dressing these trees consists in removing the superfluous wood; for it is remarked, that trees loaded with too much wood produce neither so much fruit nor of so good a quality.

Their propagation in England is commonly by layers. The laying is performed on the young branches in spring. Give plenty of water all summer, and they will sometimes be rooted and fit for potting off in autumn; but sometimes they require two summers to be rooted effectually: when, however, they are properly rooted, take them off early in autumn, and pot them separately: give water, and place them in the shade till they have taken fresh root; and in October remove them into the green-house, &c.

Those you intend to plant in the open ground, as before suggested, should be kept in pots, in order to have occasional shelter of a garden frame two or three years, till they have acquired some size, and are hardened to the full air; then transplant them into a warm border against a wall: mulch their roots in winter, and mat their tops in frosty weather.

Olives have an acrid, bitter, extremely disagreeable taste: pickled (as we receive them from abroad) they prove less disagreeable. The Lucca olives, which are smaller than the others, have the weakest taste; the Spanish, or larger, the strongest; the Provence, which are of a middling size, are generally the most esteemed.

When olives are intended for preservation, they are gathered before they are ripe. The art of preparing them consists in removing their bitterness, in preserving them green, and in impregnating them with a brine of aromatized sea salt, which gives them an agreeable taste. For this purpose different methods are employed. Formerly they used a mixture of a pound of quicklime, with six pounds of newly sifted wood ashes; but of late, instead of the ashes, they employ nothing but a lye. This, it is alleged, softens the olives, makes them more agreeable to the taste, and less hurtful to the constitution. In some parts of Provence, after the olives have lain some time in the brine, they remove them, take out the kernel, and put a caper in its place. These olives they preserve in excellent oil; and when thus prepared, they strongly stimulate the appetite in winter. Olives perfectly ripe are soft and of a dark red colour. They are then eaten without any preparation, excepting only a seasoning of pepper, salt, and oil; for they are extremely tart, bitter, and corrosive.

The oil is undoubtedly that part of the produce of olive trees which is of greatest value. The quality of it depends on the nature of the soil where the trees grow, on the kind of olive from which it is expressed, on the care which is taken in the gathering and pressing of the fruit, and likewise on the separation of the part to be extracted. Unripe olives give an intolerable bitterness to the oil; when they are over ripe, the oil has an unguinous taste: it is therefore of importance to choose the true point of maturity. When the situation is favourable, those species of olives are cultivated which yield fine oils; otherwise, they cultivate such species of trees as bear a great quantity of fruit, and they extract oil from it, for the use of soaperies, and for lamps.

They gather the olives about the months of November or December. It is best to put them as soon as possible into baskets, or into bags made of wool or hair, and to press them immediately, in order to extract a fine oil. Those who make oil only for soaperies, let them remain in heaps for some time in their store houses; when afterwards pressed, they yield a much greater quantity of oil. Those even who extract oil to be used in food, sometimes allow them to ferment in heaps, that they may have more oil; but this is extremely hurtful to the quality of the oil, and is the reason why fine oil is so very rare. M. Duhamel recommends not to mix sound olives with those in which a fermentation has already begun, and still less with such as are putrified: in both cases, the oil which is extracted is of a bad quality, and unfit for preservation. In order to have the oil in its purity, we must allow it to deposite its sediment, and then pour it off into another vessel. The oil extracted from the pulp only of olives is the most perfect which can be obtained, and will keep for several years; but that which

Olea.

is extracted from the kernel only, or from the nut, or from the whole olive ground in the common way in public mills, has always more or fewer defects, loses its limpidity in a certain time, and is very apt to become rancid. Care must taken likewise to keep the oil in proper vessels well shut. After all, in the course of time, olive oil loses its qualities, becomes disagreeable to the taste and smell, diminishes in fluidity, and at length thickens considerably.

The refuse of the first pressing, when squeezed a second time, yields an oil, but thicker and less pure than the former. What remains after the second pressing, when mixed with a little water and placed in a pan over the fire, produces by pressure a third oil, but of a very inferior quality. What remains after all the oil is expressed, is termed *grignon*, and is of no farther use but as fuel.

The sediment, or *faeces*, of new oil, we name after the ancients, *amurca*: it is an excellent remedy in rheumatic affections. In Paris the wax used for shoes is commonly made of the dregs of defecated oil and smoke-black.

Oil of olives is an ingredient in the composition of a great many balsams, ointments, plasters, mollifying and relaxing liniments. It is of an emollient and solvent nature; mitigates gripes of the colic, and the pains accompanying dysentery; and is one the best remedies when one has chanced to swallow corrosive poisons; but it by no means prevents the fatal accidents which ensue from the bite of a snake, as has been pretended. It is an effectual cure, as M. Bourgeois tells us, for the sting of wasps, bees, and other insects. A bandage soaked in the oil is immediately applied to the sting, and a cure is obtained without any inflammation or swelling.

Olive oil is of no use in painting, because it never dries completely. The best soap is made of it, mixed with Alicant salt-wort and quicklime.

Great drought, as well as much rain, is extremely injurious to the crop of olives. This fruit is much exposed to the attacks of a worm peculiar to itself, and which injures it so much, that after the olives are gathered the produce of the oil extracted from them is diminished one half.

The wood of the olive tree is beautifully veined, and has a pretty agreeable smell: it is in great esteem with cabinetmakers, on account of the fine polish which it assumes. It is of a resinous nature, and consequently excellent for burning.

As the laurel branch is the symbol of glory, so the olive branch covered with leaves has from the most ancient times been the emblem of concord, the symbol of friendship and peace.

The leaves of olive trees have an astringent quality. Many people use them in making gargles for inflammations of the throat.

These plants in this country must be kept principally in pots for moving to the shelter of a green-house in winter; for they are too tender to prosper well in the open ground in this climate: though sometimes they are planted against a warm south wall, and sheltered occasionally from frost in winter, by mulching the roots, and matting their tops; whereby they may be preserved, and will sometimes produce fruit for pickling: a very severe winter, however, often kills or greatly injures their young branches; therefore let the principal part be potted in rich earth, and placed among the green-house shrubs, and managed as others of that kind.

Oleaginous || Olearius.

These trees are often sent over from Italy to the Italian warehouses in London, along with orange-trees, &c. where pretty large plants may be purchased reasonably, which should be managed as directed for orange trees that are imported from the same country. See Citrus.

OLEAGINOUS, something that partakes of the nature of oil, or out of which oil may be expressed.

OLEANDER, or rose bay, *nerium*: A genus of the pentandria monogynia class. Its characters are these: The empalement of the flower is permanent and cut into five acute segments; the flower has one funnel-shaped petal, cut into five broad obtuse segments, which are oblique; it hath a nectarium, terminating the tube, which is torn into hairy segments; it hath five short awl-shaped stamina within the tube; it hath an oblong germen, which is bifid, with scarce any style, crowned by single stigmas; the germen afterwards turns to two long, taper, acute-pointed pods, filled with oblong seeds lying over each other like the scales of a fish, and crowned with down. There are four species.

These plants are generally propagated by layers in this country; for although they will take root from cuttings, yet that being an uncertain method, the other is generally preferred; and as the plants are very apt to produce suckers or shoots from their roots, those are best adapted for laying; for the old branches will not put out roots: when these are laid down, they should be slit at a joint, in the same manner as is practised in laying of carnations. There are few plants which are equal to them either to the sight or smell, for their scent is very like that of the flowers of the white thorn; and the bunches of flowers will be very large if the plants are strong.

It is called *nerium* from νηρος, "humid," because it grows in humid places. The plant itself has a force which is insuperable; for its juice excites so great and violent an inflammation, as immediately to put a stop to deglutition; and if it be received into the stomach, that part is rendered incapable of retaining any thing; the pernicious drug exerting its force, and purging both upwards and downwards.

Nerium in qualities resembles the apocynum. See Apocynum. But when handled and examined upon an empty stomach, in a close chamber, it causes a numbness coming by degrees, with a pain in the head; which shows that something poisonous belongs even to the smell, though there is no danger if it be received in the open air as may be found upon trial. Antidotes against its poison are vinegar and all acids.

OLEARIUS (Adam), minister to the duke of Holstein, and secretary to the embassy sent in 1633 to the great duke of Muscovy and to the king of Persia. He spent six years in this employment: and, on his return, published a relation of his journeys, with maps and figures, at Sleswic, 1656, in folio. He wrote an *Abridgment of the Chronicles of Holstein from* 1448 *to* 1663; and was appointed librarian to the duke of Holstein, in which capacity he probably died. He has the character of an able mathematician, an adept

in music, and a good orientalist, especially in the Persian language.

Olearius (Godfrey), son of Godfrey Olearius, D. D. superintendent of Halle in Saxony, was born there in 1639. He became professor of Greek at Leipsic; and showed his abilities in that language by 52 exercitations on the dominical epistles, and upon those parts of the epistles in the New Testament which are read in the public exercises, and which among the Lutherans are the subject of part of their sermons. He discharged the most important posts in the university, and among other dignities was ten times rector of it. His learning and industry were displayed in 106 theological disputations, 61 in philosophy, some programmas upon difficult points, several speeches and theological counsels; which make two thick volumes: beside his Moral Theology, his introduction to Theology, which treats of cases of conscience, and his *Hermeneutica Sacra.* He lived to a good old age, dying in 1713. His eldest son of his own name was a man of genius and learning, a professor in the same university, who published several works, but died young of a consumption before his father.

OLECRANUM, or Olecranon, in anatomy, the protuberance of the ulna, which prevents the joint of the elbow from being bent back beyond a certain length. See Anatomy, N° 51.

OLENUS, a Greek poet, older than Orpheus, came from Xanthe, a city of Lycia. He composed several hymns, which were sung in the island of Delos upon festival days. Olenus is said to have been one of the founders of the oracle at Delphi; to have been the first who filled at that place the office of priest of Apollo; and to have given responses in verse: but the truth of these assertions is very doubtful.

OLERON, an island of France, on the coast of Aunis and Saintonge, about five miles from the continent. It is 12 miles in length, and five in breadth; and is very fertile, containing about 12,000 inhabitants, who are excellent seamen. It is defended by a castle, which is well fortified; and there is a lighthouse placed there for the direction of ships. It is 14 miles south-east of Rochelle. W. Long. 1. 26. N. Lat. 46. 10.

*Sea Laws of Oleron,* certain laws relative to maritime affairs, made in the time of Richard I. when he was at the island of Oleron. These laws, being accounted the most excellent sea laws in the world, and recorded in the black book of the admiralty. See *Selden's Mare Clausum.*

OLEUM palmæ christi, commonly called *castor oil,* is extracted from the kernel of the fruit produced by the *Ricinus Americanus.* (See Ricinus). This oil has been much used as a purgative in medicine. It acts gently on the bowels, with little or no irritation. By many physicians it has been deemed a sovereign remedy in bilious, calculous, and nephritic complaints; but its taste is extremely nauseous, and, when frequently used, it is apt to relax the tone of the bowels. It is recommended to be given in clysters; and Dr Canvane of Bath affirms, that when children cannot be made to swallow any medicine, if the navel and hypochondria be rubbed with this oil, it will produce one or two physical stools. He adds, that given in small draughts, or by clyster, or by embrocation, it is an excellent and wonderful vermifuge.



OLFACTORY nerves. See Anatomy, N° 136 and 140.

OLGA, queen of Igor the second monarch of Russia, who flourished about the year 880, having succeeded his father Ruric, who died in 878. Olga was born in Plescow, and was of the best family in that city. She bore him one son, called *Swetoslaw.* Igor being murdered by the Drewenses, or Drewliani, Olga revenged his death. She went afterwards, for what reason we know not, to Constantinople, where she was baptized, and received the name of *Helena.*

The emperor John Zimisces was her godfather, and fell in love with her as we are told; but she, alleging their spiritual alliance, refused to marry him. Her example made some impression upon her subjects, a good number of whom became converts to Christianity; but none upon her son, who reigned for a long time after her death, which happened at Pereslaw, in the 80th year of her age, 14 years after her baptism. The Russians to this day rank her among their saints, and commemorate her festival on the 11th of July.

OLIBANUM, in pharmacy, a gummy resin, the product of the *juniperus lycia* (Lin.), brought from Turkey and the East Indies, usually in drops or tears like those of mastich, but larger; of a pale yellowish, and sometimes reddish, colour; a moderately warm pungent taste, and a strong, not very agreeable smell. This drug has received many different appellations, according to its different appearances: the single tears are called simply *olibanum* or *thus;* when two are joined together, they have been called *thus masculum,* and when very large, *thus fœmininum:* sometimes four or five, about the bigness of filberds, are found adhering to a piece of the bark of the tree which they exuded from; these have been named *thus corticosum:* the finer powder which rubs off from the tears in the carriage, *mica thuris;* and the coarser powder, *manna thuris.* This drug is not however, in any of its states, what is now called *thus* or *frankincense* in the shops. See the article Thus.

Olibanum consists of about equal parts of a gummy and resinous substance; the first soluble in water, the other in rectified spirit. With regard to its virtues, abundance have been attributed to it, particularly in disorders of the head and breast, in hæmoptoes, and in alvine and uterine fluxes: but its real effects in these cases are far from answering the promises of the recommenders. Riverius is said to have had large experience of the good effects of this drug in pleurisies, especially epidemic ones: he directs a scooped apple to be filled with a dram of olibanum, then covered and roasted under the ashes; this is to be taken for a dose, three ounces of carduus water after it, and the patient covered up warm in bed; in a short time, he says, either a plentiful sweat, or a gentle diarrhœa, ensues, which carry off the disease. Geoffroy informs us, that he has frequently made use of this medicine after venesection, with good success; but acknowledges that it has sometimes failed.

OLIGÆDRA, in natural history, the name of a genus of crystals composed of very few planes, as the name expresses. The word is compounded of ὀλιγος "a few,"

few," and ἕδρα "a plane." The bodies of this class are crystals of the imperfect kind; being composed of columns affixed irregularly to some solid body at one end, and the other terminated by a pyramid: but the column and pyramid being both pentangular, the whole consists only of ten planes, and not, as the common kind, of 12.

OLIGARCHY, a form of government wherein the administration of affairs is confined to a few hands.

OLIO, or OGLIO, a savoury dish, or food, composed of a great variety of ingredients; chiefly found at Spanish tables.

The forms of olios are various. To give a notion of this strange assemblage, we shall here add one from an approved author.

Take rump of beef, neats tongues boiled and dried, and Bologna sausages; boil them together, and, after boiling two hours, add mutton, pork, venison and bacon, cut in bits; as also turnips, carrots, onions, and cabbage, borage, endive, marigolds, sorrel, and spinach; then spices, as saffron, cloves, mace, nutmeg, &c. This done, in another pot put a turkey or goose, with capons, pheasants, wigeons, and ducks, partridges, teals, and stock-doves, snipes, quails, and larks, and boil them in water and salt. In a third vessel, prepare a sauce of white wine, strong broth, butter, bottoms of artichokes, and chesnuts, with cauliflowers, bread, marrow, yolks of eggs, mace, and saffron. Lastly, Dish the olio, by first laying out the beef and veal, then the venison, mutton, tongues, and sausages, and the roots over all; then the largest fowls, then the smallest, and lastly pour on the sauce.

OLISIPO, (Pliny, Antonine, Inscriptions); a town of Lusitania, situated on the north side of the frith of the Tagus; of such antiquity, that Solinus thought it was built by Ulysses; and Mela, probably to favour this opinion, writes, according to the common copies, *Ulyssipo*; both of them perhaps deceived by the similarity of sound. It was a municipium, with the surname *Felicitas Julia*, a privilege granted by the munificence of Augustus, (Inscriptions, Pliny). Now Lisbon, capital of Portugal, situated on the north bank of the Tagus, distant about ten miles from its mouth. See LISBON.

OLIVAREZ (Count de), by name *Don Gaspar de Guzman*, favourite and minister to Don Philip IV. of Spain, about 1620; a man of great parts and boundless ambition. Philip no sooner became king, than he became the subject of this his favourite. The king had abilities, it is true, but they lay dormant; and whilst he spent his time in listless inactivity, the whole government was under the direction of Olivarez. The count's management, indeed, was sufficiently dexterous in accomplishing his own designs; for by the best framed excuses, and on the most plausible pretexts, he removed all such as he thought stood in his way; nor did he stop there, but sometimes persecuted his rivals even to death, of which Don Rodrigo Calderona was a melancholy instance, an instance which at that time excited universal compassion. This minister, in short, had a genius of no common kind; added to which, he had a disposition which spurned all controul.

He had persecuted the late ministry for their pusillanimity in the management of affairs; he therefore thought it necessary, and it was certainly prudent, to pursue new measures. His self-sufficiency, though unbounded, was concealed under the veil of assumed modesty, and he was careful to make it appear that he was wholly taken up with the things of his own province. His politics were of a refined perhaps, but not of a very useful, tendency; for his imprudence, or his wrong notions on the subject, made him renew a war with Holland, contrary to the universal opinion of the council and the people. By the same imprudence, or by something worse, he provoked England, and obliged her to endeavour to humble the pride and lessen the authority of the house of Austria. Thus far he had been of little service to his country, having only provoked the resentment of the most powerful states, particularly England, France, Holland, &c. to conspire for its ruin. It is remarkable that Olivarez, notwithstanding this, never lost his credit; and indeed things so turned about in the end, that though Spain for a whole year was put to the severest trials, it acquired a degree of fame which sufficiently, in the general opinion, overbalanced some little loss. Olivarez too was particularly fortunate in making the peace; in which transaction he gained a very considerable advantage over Richelieu, so that things appeared to be still in a very favourable train. Fortune, however, was not always quite so indulgent to the schemes of this minister: he again drew Spain into a war with Mantua, contrary to the sentiments of the wisest men; from which is justly dated its declension, if not its ruin.

On the whole, Olivarez seems to have been always averse to peace; and with such a restless disposition, it is undoubtedly wonderful that he held his place so long and with so few complaints as he did.

It was certainly owing to his ambition and obstinacy, that an almost general war was excited about the year 1627, and which, as we have said, proved so fatal to Spain. So averse, indeed, does he appear to have been to peace, that he used every means in his power to prevent the restoration of it in Italy; and for this very purpose he sent Feria into Milan, whom he knew to be a man of such a temper and abilities as suited his purposes; for he was naturally averse to quiet. He endeavoured to break the alliances of the duke of Mantua by various stratagems; but they did not succeed: the schemes of Olivarez and the intrigues of Feria being totally defeated. Our minister had soon after this another cause of mortification, on Richelieu's being created a duke and peer of France, and unanimously admitted among the Venetian nobility; which could not fail to be a severe stroke on Olivarez, who considered him as his implacable enemy.

The people at length began to see and to be displeased with his conduct; and with reason, had they known it all, for it was in many instances cruel and detestable. Indeed the differences which at that time had so long subsisted between France and Spain were the effect of the private animosity between him and Richelieu. Things, however, so turned about, and Spain was so unusually successful, that the faults of the minister were overlooked for the time; but this unexpected good fortune had no other effect than that of making him

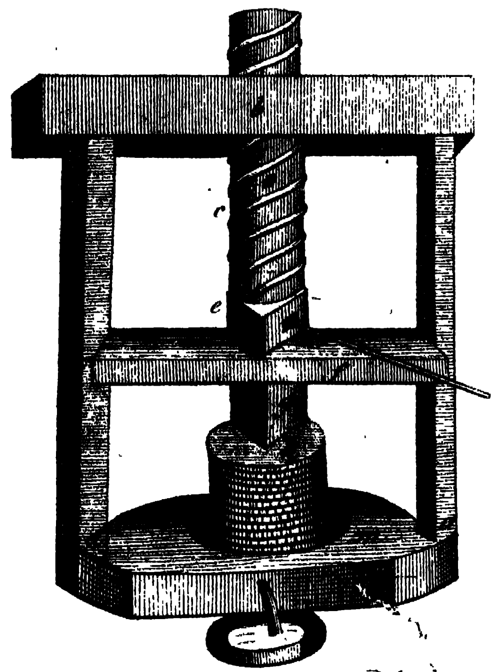
The Nut Cracker.

Spotted or Surinam Nuthatch.

Oenanthe, or Water Drop-wort.


Nyl Ghau.

Olive Press.




A. Bell Prin. Wal. Sculptor fecit.

Olivarez. him far more insolent than ever. He was, in every instance, one of the most headstrong and obstinate men in the world: he had set his heart on the reduction of Casal in Italy, and he was determined on it at whatever hazard; this foolish enterprise was, however, unaccountably defeated, and the Spanish army experienced a total defeat.

The revolt of the Catalans, whom he wished to deprive of their privileges, was the next consequence of his folly? he had privately employed the Marquis de los Velez to extinguish this rebellion; but the cruelty of the measures used for this purpose only inflamed it the more. The revolution of Portugal, another disastrous event, was also the result of his obstinacy and rigour.

This series of ill fortune, which ought to have opened the eyes of the Catholic king and his ministers, seemed to infatuate both. The great secret by which Olivarez had governed his master was being the companion, or at least the confidant, of his pleasures. While he affected to deceive the world with a specious appearance of religion and piety, he was not only immersed in vice himself, but encouraged and promoted it in his prince, to the scandal of his subjects, and the prejudice of his affairs. At this time, of all others the most improper, Olivarez produced a bastard of his, hitherto called *Julian;* he had taken so little care of this son, that, not able to subsist in Spain he had passed over to the Indies, where, in very mean stations, he had scarce got bread. On him he now bestowed the name of *Don Henrico de Guzman;* and bringing him with great pomp and splendour to court, either flattered or forced the constable of Castile to give him his daughter; in consideration of which alliance he was to devolve upon him his duchy of St Lucar. In the beginning of his administration, by some accident or other, he presented to the king a memorial, in relation to an affair upon which his majesty had already received one from Don Balthasar de Zuniga: upon comparing them, they contradicted each other flatly. The king ordered a a person of great quality to inquire thoroughly into this business; in consequence of which Don Balthasar's memorial appeared to be the truth, and that of Olivarez the reverse of it. The king was very angry; but the count regained his favour, by procuring for him the fair actress Calderona. By this woman he had a son, of whom no great notice was taken; but now, to obscure the folly of the count duke, this youth, scarce in the 14th year of his age, was produced, with the title of *Don Juan of Austria,* and declared generalissimo of the army against Portugal; while the heir apparent to the crown, Don Balthasar, was left under the tuition, or rather in the custody of the countess of Olivarez; at which conduct the queen was chagrined, the people enraged, and the world in general astonished.

His schemes now began to be entirely broken and defeated everywhere and in every kind; he fell under the displeasure of the queen, the emperor, the grandees, and the people all at once, and experienced the disgrace he had long merited. His ill fortune, which came upon him with the force of a torrent, did not, however, wholly overpower him; he was indeed obliged to conceal himself, in order to avoid the rage of the populace: but he had still confidence enough to offer an apology for his conduct, which possessed no inconsiderable share of wit and humour, well tempered with spirit and masterly reasoning. It was not, however, of any consequence to him; for he was banished to Toro, where, worn out by infirmities, or overcome by despair, he ended his days about the year 1645.

Olive, Oliver.

OLIVE, in botany. See OLEA.

*Olive Press.* In order to obtain the olive oil, the olives are first bruised in a rough trough, under a millstone, rolling perpendicularly over them; and when sufficiently mashed, put into the maye or trough, *m*, of an olive press, where *aa* are the upright beams, or cheeks; *b*, the female, and *c*, the male screw; *f*, the board on which the screw presses; *g*, a cubical piece of wood, called a *block;* *h*, the peel, a circular board, to be put under the block. By turning the screw, all the liquor is pressed out of the mashed olives, and is called *virgin oil;* after which, hot water being poured upon the remainder in the press, a coarser oil is obtained. Olive oil keeps only about a year, after which it degenerates. Plate CCCXLVII.

*Olive Colour,* a yellow mingled with black.

Olive (Peter John), was born in France, and died in 1297, in the fiftieth year of his age. In his youth he wrote a book in praise of the Virgin Mary, which was condemned during the pontificate of Nicholas III. as containing some things too extravagant. He afterwards was frequently accused by the brothers of his order, whose resentment he had drawn upon himself by his severe reproofs of their luxury, and his endeavours to recal them to the poverty and rigour of their first institution. After his death his body was dug up, he was condemned as a heretic, and his writings were burnt, and remained prohibited till the time of Sixtus IV. who having ordered them to be examined, declared they contained nothing expressly contrary to the Catholic faith. The propositions condemned by John are mentioned by Emmericus, in his Directory of the Inquisition, under twenty-two heads. The chief of them are, "That the Pope was the mystical Antichrist; that St Francis was the angel in the Revelation said to have the mark of the living God, and that his rule was the true gospel; that the perfect state of the church began with St Francis; and that Christ and his apostles had no property, either in common or in particular, but only the usufruct of what they enjoyed."

OLIVER (Isaac), an excellent English painter, born in 1556, eminent both for history and portraits. Several fine miniatures of this master are to be seen in the collections of our nobility and gentry; some of them portraits of himself. As he was a very good designer, his drawings are finished in an extraordinary degree of perfection; many being copies after Parmegiano. Rubens and Vandyck painted James I. after a miniature of Oliver's, which is a sufficient testimony of his merit. He died in 1617.

Oliver (Peter), the son and disciple of Isaac Oliver, was born in 1601. He arrived at a degree of perfection in miniature portaits confessedly superior to his father, or any of his cotemporaries, as he did not confine his subjects to a head only. In the collections of Charles I. and James II. there were 13 historical subjects painted by this Oliver; of which seven are still preserved

preferved in the clofet of Queen Caroline at Kenfington; and a capital painting of his wife is in the poffeffion of the duchefs of Portland. He died in 1660.

OLIVET, or *Mount of Olives* (anc. geog.), was fituated to the eaft of the city of Jerufalem, and parted from the city only by the brook Kidron, and by the valley of Jehofhaphat, which ftretches out from the north to the fouth. It was upon this mount that Solomon built temples to the gods of the Ammonites (1 Kings xi. 7.) and of the Moabites, out of complaifance to his wives, who were natives of thefe nations. Hence it is that the Mount of Olives is called the *mountain of corruption* (2 Kings xxiii. 13.) Jofephus fays, that this mountain is at the diftance of five ftadia, or furlongs, from Jerufalem, which make 625 geometrical paces, or the length of a Sabbath day's journey, fays St Luke (Acts i. 12.) The Mount of Olives had three fummits, or was compofed of three feveral mountains, ranged one after another from north to fouth. The middle fummit is that from whence our Saviour afcended into heaven. It was upon that towards the fouth that Solomon built temples to his idols. The fummit which is moft to the north is diftant two furlongs from the middlemoft. This is the higheft of the three, and is commonly called Galilee.

In the time of King Uzziah, the Mount of Olives was fo fhattered by an earthquake, that half of the earth that was on the weftern fide fell down, and rolled four furlongs or 500 paces from thence, towards the mountain which was oppofite to it on the eaft; fo that the earth blocked up the highways, and covered the king's gardens.

Mr Maundrell tells us that he and his company going out of Jerufalem at St Stephen's gate, and croffing the valley of Jehofhaphat, began immediately to afcend the mountain; that being got above two-thirds of the way up, they came to certain grottos cut with intricate windings and caverns under ground, which were called the fepulchres of the prophets; that a little higher up were twelve arched vaults under ground, ftanding fide by fide, and built in memory of the apoftles, who are faid to have compiled their creed in this place; that fixty paces higher they came to the place where Chrift is faid to have uttered his prophecy concerning the final deftruction of Jerufalem; and a little on the right hand, to another, where he is faid to have dictated a fecond time the Lord's prayer to his difciples; that fomewhat higher is the cave of a faint called *Pelagia;* a little above that, a pillar denoting the place where an angel gave the Bleffed Virgin three days warning of her death; and at the top of all, the place of our bleffed Lord's afcenfion.

OLIVETAN (Robert), related to the famous Calvin, printed at Neufchatel in 1535, in folio, a verfion of the Bible into French, the firft which had been tranflated from the original Hebrew and Greek. It is written in an uncouth and barbarous ftyle, and is far from being faithful. The characters in which it is printed are Gothic, and the language of it is no lefs fo. It is valued only becaufe it is rare to be found. Calvin is thought to have had a very confiderable fhare in this tranflation. Olivetan furvived his publication but a fhort time; for he was poifoned at Rome the year after, of which his tranflation is alleged to have been the caufe. Olivetan's Bible, revifed by John Calvin and N. Malinger, was reprinted at Geneva, in 1540, in quarto. This edition is ftill rarer than the former. It is called the *Bible de l'Epée*, becaufe the printer had a fword for his fign.



OLIVIER (Claude Matthieu), advocate of the parliament of Aix, was born at Marfeilles in 1701, and appeared at the bar with eclat. He had a chief hand in the eftablifhment of the academy of Marfeilles, and was one of its original members. He poffeffed a quick and lively genius. A few hours retirement from fociety and from his pleafures were frequently fufficient to enable him to fpeak and write, even on important caufes; but his works commonly bore marks of hafte. Given to excefs in every thing, he would employ a fortnight in ftudying the Code and the Digeft, or in ftoring his mind with the beauties of Demofthenes, Homer, Cicero, or Boffuet; and then abandon himfelf for another fortnight, frequently a whole month, to a life of frivolity and diffipation. He died in 1736, at the age of 35. He publifhed 1. *L'Hiftoire de Philippe roi de Macedoine, et pere d'Alexandre le Grand,* 2 vols. 12mo. No writer has fo ably handled the hiftory of the age of Philip, the interefts of the different nations of Greece, and their manners and cuftoms: but the conduct of the work is extremely defective. The digreffions are too frequent, and often tedious. The ftyle is in no refpect fuitable to a hiftory. It is in general dry, unconnected, and like the ftyle of a differtation. Sometimes, however, we find in it paffages full of fire and beauty, and turns of expreffion truly original. A difeafe of the brain, with which he was attacked, and under which he laboured feveral years, prevented him from putting his laft hand to the work. 2. *Mémoire fur les fecours donnés aux Romains par les Marfeillois pendant la 2de Guerre Punique.* 3. *Mémoire fur les fecours donnés aux Romains par les Marfeillois durant la Guerre contre les Gaulois.*

OLMUTZ, a town of Germany, in Moravia, with a bifhop's fee, and a famous univerfity. The public buildings are very handfome, particularly the Jefuits college. It is a populous, trading, and very ftrong place; and yet it was taken, with the whole garrifon, by the king of Pruffia in 1741. In July 1758 he befieged it again; and when he had almoft taken the place he was obliged to raife the fiege, to go and meet the Ruffian army. It is feated on the river Morave. E. Long. 17. 35. N. Lat. 49. 30.

OLOCENTROS, in natural hiftory, a name given by the old Greeks to a fmall animal of the fpider kind, whofe bite was accounted mortal. It is the fame with the folipuga, fo called from its ftinging, or biting moft violently, in places, or feafons, where the fun had the moft power, as Africa, &c. The name *folifuga* was a corrupt way of writing that word; and this feems alfo a falfe way of writing the word *heliocentros,* which fignifies the fame as folipuga.

OLYMPIA (Maldachini Donna), a woman of a very uncommon character. She flourifhed about the middle of the laft century. She was fifter-in-law to Pope Innocent X. and had the addrefs to acquire an unlimited power over this vain, weak, and injudicious ecclefiaftic. Her fon Camillo was promoted to the cardinalate, under the title of Pamphilio; but falling in love with the Princefs Roffana, a beautiful young widow, he laid afide his hat, and married. The crime, if it was one, was efteemed by the Romans in general at leaft venial.

Olympia. nial. The pope, however, was displeased; and Olympia procured their banishment, being afraid lest her daughter-in-law should lessen her authority in the *sacred court*. This authority, equally unnatural and uncommon, reflected neither honour on her who held it, nor on the man who allowed her to hold it. Such elevated situations, however, whether they are the reward of merit, the effect of chance, or acquired by cunning, are seldom very secure. Olympia, who had procured the disgrace of many who did not deserve it, and who had herself long merited such a fate, at length experienced both disgrace and banishment. This was obtained by means of Cardinal Panzirollo, a great favourite of the pope's. The immediate cause of it was this: The pope had determined, in order to lessen his own trouble, to adopt a nephew, and to make him a *Cardinal Patron*, in order to give audience to ambassadors and ministers, and in his absence to preside at the council. For this purpose, at the recommendation of his favourite, his holiness made choice of Astalli, brother of the marquis Astalli, who had married a niece of Olympia. Olympia indeed was slightly consulted on the affair, and showed no disapprobation of the appointment. The pope, however, no sooner got him fixed in his new office, than he showed his own weakness by repenting of it. Olympia too was displeased, and by her solicitations procured the disgrace of Astalli, before he had enjoyed either the honours or emoluments of his office. Panzirollo, however, soon managed matters so as to turn the scales: he prevailed on the pope again to countenance and honour Astalli; and, what was more, had influence sufficient to persuade him to disgrace Olympia, and to banish her the court. She had indeed abused her authority in a most scandalous manner, and had gained such an absolute ascendant over the pope, that in every thing his will had been subservient to her dictates.—Her avarice and ambition were unbounded: she disposed of all benefices, which were kept vacant till she fully informed herself of their value: she rated an office of 1000 crowns for three years, at one year's revenue, and if for life, at 12 years purchase, one half of which sum she required to be paid in advance: she gave audience upon public affairs, enacted new laws, abrogated those of former popes, and sat in council with Innocent, with bundles of memorials in her hands. It was generally said that they lived together in a criminal correspondence, and that she had charmed him by some secret incantation. In the Protestant countries the loves and intrigues of Innocent and Donna Olympia were represented upon the stage; and severe sarcasms were daily put into the hands of Pasquin at Rome.—As she had usurped such an absolute authority, the new cardinal nephew saw the necessity of ruining her credit; he therefore seconded the endeavours of Panzirollo.—He insinuated to the pope, that his reputation had suffered greatly among the Catholics by her scandalous proceedings, and that his nuncios were treated with disrespect and contempt at the courts of the emperor, France, and Spain. Upon these representations, Innocent at length, but with great reluctance, banished Olympia, and was reconciled to Prince Camillo and the Princess Rossana; though some authors affirm that her banishment was no more than a political retreat, and that she still in private directed the affairs of the pope. A woman of Olympia's character, however, with such unbounded ambition, such an extravagant lust for power, Olympia. and such an ambitious desire of wealth, and who had once possessed so great an ascendency over such a man as Innocent, was not to be so easily put off. She was banished in 1650; but in 1653, she again assumed the supreme direction of affairs just as before her disgrace. She again accomplished the disgrace of Astalli, and procured the promotion of Azzolini to the office of secretary of the briefs. In 1654, his holiness resigned himself entirely into the hands of this assuming woman; who, observing his infirmities daily increasing, redoubled her rapacity, disposing of benefices to the highest bidders in all parts of Italy. She was again, however, in hazard of being displaced by a new favourite, *viz*. the cardinal de Retz; and had not the pope's dissolution prevented it, it would in all probability quickly have taken place. During his last illness he received nothing but from the hands of Donna Olympia, who was at great pains to prolong his life, watched continually at his bed side, and prevented the ambassadors or others from disturbing him with discourses upon business. She is said, during the last ten days of his life, when he continued without the use of reason, to have amassed about half a million of crowns. She did not find the succeeding pope (Alexander VII.) so easy to be played upon as his weak predecessor: a number of memorials were sent in against her, and his holiness was well disposed to attend to them: he ordered her to retire from Rome, and at the same time began to examine witnesses respecting her conduct. She was cut off, however, before the trial was finished, by the plague, which, in 1636, afflicted Rome and its neighbourhood. Her estate was not confiscated as was generally expected; and the prince Pamphilio was allowed to succeed her. The pope only reserved for his own relations about a million of crowns.

Olympia (anc. geog.), with the surname *Pisatis* (Strabo); so called from the territory of Pisa in Elis; described by Strabo, "as the temple of Jupiter Olympius, before which stands a grove of wild olive trees, in which is the stadium, or foot-course, so called because the eighth part of a mile; and by which the Alpheus, coming down from Arcadia, runs." Olympia, however, was famous not merely for the temple of Jupiter, but also for a temple of Juno, 63 feet long, with columns round it of the Doric order; and a Metroum or temple of the mother of the gods, a large Doric edifice; with holy treasuries. These, and the porticoes, a gymnasium, prytaneum, and many more buildings, chiefly in the enclosure, with the houses of the priests and other inhabitants, made Olympia no inconsiderable place. The stadium was in the grove of wild olive trees, before the great temple; and near it was the hippodrome or course for the races of horses and chariots. The Alpheus flowed by from Arcadia with a copious and very pleasant stream, which was received on the coast by the Sicilian sea.

The temple of Jupiter was of the Doric order, 68 feet high to the pediment, 95 wide, and 230 long; the cell encompassed with columns. It was erected with the country stone; the roof not of earth baked, but of Pentelic marble; the slabs disposed as tiles; the way to it up a winding staircase. The two pediments were enriched with sculpture; and one had over the centre a statue of Victory gilded; and underneath a votive

 buckler

Olympia. buckler of gold. At each corner was a gilded vase. Above the columns were fixed 21 gilded bucklers, offered at the conclusion of the Achæan war by the Roman general Mummius. The gates in the two fronts were of brass, and over them were carved the labours of Hercules. Within the cell were double colonnades, between which was the approach to the image.

The Jupiter of Olympia was accounted alone sufficient to immortalize its maker, Phidias. It was of ivory and gold, the head crowned with olive. In the right hand was a statue of Victory; in the left a flowered sceptre, composed of various metals, on which was an eagle. The sandals were of gold, as also the vestment, which was curiously embossed with lilies and animals. The throne was gold inlaid with ebony and ivory, and studded with jewels, intermixed with paintings and exquisite figures in relievo. The pillars between the feet contributed to its support. Before it were walls, serving as a fence, decorated principally with the exploits of Hercules; the portion opposite to the door of a blue colour. It was the office of a family descended from Phidias, called *phædruntæ* or *the polishers*, to keep the work bright and clean. The veil or curtain was cloth rich with the purple dye of Phœnicia and with Assyrian embroidery, an offering of King Antiochus, and was let down from above by loosening the strings. The image impressed on the spectator an opinion that it was higher and wider than it measured. Its magnitude was such, that though the temple was very large, the artist seemed to have erred in the proportions. The god, sitting, nearly touched the ceiling with his head; suggesting an idea, that if he were to rise up, he would destroy the roof. A part of the pavement before it was of black marble, enclosed in a rim of Parian or white, where they poured oil to preserve the ivory.

The altar of Jupiter Olympius was of great antiquity, and composed of ashes from the thighs of the victims, which were carried up and consumed on the top with wood of the white poplar tree. The ashes also of the prytaneum, in which a perpetual fire was kept on a hearth, were removed annually on a fixed day, and spread on it, being first mingled with water from the Alpheus. The cement, it was affirmed, could be made with that fluid only; and therefore this river was much respected, and esteemed the most friendly of any to the god. On each side of the altar were stone steps. Its height was 22 feet. Girls and women, when allowed to be at Olympia, were suffered to ascend the basement, which was 125 feet in circumference. The people of Elis sacrificed daily, and private persons as often as they chose.

Religion flourished at Olympia, and many deities were worshipped besides Jupiter. Pausanias has enumerated above 60 altars of various shapes and kinds. One of the unknown gods stood by the great altar. The people of Elis offered on all these monthly; laying on them boughs of olive; burning incense, and wheat mixed with honey; and pouring libations of such liquors as the ritual prescribed. At the latter ceremony sometimes a form of prayer was used, and they sung hymns composed in the Doric dialect.

Olympia was situated on an eminence, between two mountains called *Ossa* and *Olympus*. Though its ancient splendour is gone, the place reminds the traveller of what it once was. It is in the Morea, being now a small place called *Longinico*, 50 miles south of Lepanto, in E. Long. 22. 0. N. Lat. 37. 40.

Olympiad, Olympias.

OLYMPIAD, the space of four years, whereby the Greeks reckoned time.—The first Olympiad fell, according to the accurate and learned computation of some of the moderns, exactly 776 years before the first year of Christ, or 775 before the year of his birth, in the year of the Julian period 3938, and 22 years before the building of the city of Rome. The games were exhibited at the time of the full moon next after the summer solstice; therefore the Olympiads were of unequal length, because the time of the full moon differs 11 days every year, and for that reason they sometimes began the next day after the solstice, and at other times four weeks after. The computation by Olympiads ceased, as some suppose, after the 364th, in the year 440 of the Christian era. It was universally adopted not only by the Greeks, but by many of the neighbouring countries; though still the Pythian games served as an epoch to the people of Delphi and to the Bœotians; the Nemæan games to the Argives and Arcadians; and the Isthmian to the Corinthians and the inhabitants of the Peloponnesian isthmus. To the Olympiads history is much indebted. They have served to fix the time of many momentous events; and indeed before this method of computing time was observed, every page of history is mostly fabulous, and filled with obscurity and contradiction, and no true chronological account can be properly established and maintained with certainty.

OLYMPIAS, a celebrated woman, who was daughter of a king of Epirus, and who married Philip king of Macedonia, by whom she had Alexander the Great. Her haughtiness, and more probably her infidelity, obliged Philip to repudiate her, and to marry Cleopatra, the niece of King Attalus. Olympias was sensible of this injury, and Alexander showed his disapprobation of his father's measures, by retiring from the court to his mother. The murder of Philip, which soon followed this disgrace, and which some have attributed to the intrigues of Olympias, was productive of the greatest extravagances. The queen paid the greatest honour to her husband's murderer. She gathered his mangled limbs, placed a crown of gold on his head, and laid his ashes near those of Philip. The administration of Alexander, who had succeeded his father, was in some instances offensive to Olympias; but when the ambition of her son was concerned, she did not scruple to declare publicly that Alexander was not the son of Philip, but that he was the offspring of an enormous serpent who had supernaturally introduced himself into her bed. When Alexander was dead, Olympias seized the government of Macedonia; and, to establish her usurpation, she cruelly put to death Aridæus, with his wife Eurydice, as also Nicanor the brother of Cassander, with 100 leading men of Macedon, who were inimical to her interest. Such barbarities did not long remain unpunished: Cassander besieged her in Pydna, where she had retired with the remains of her family, and she was obliged to surrender after an obstinate siege. The conqueror ordered her to be accused, and to be put to death. A body of 200 soldiers were ordered to put the bloody commands into execution, but the

splendour

Olympic. ſplendour and majeſty of the queen diſarmed their courage; and ſhe was at laſt maſſacred by thoſe whom ſhe had cruelly deprived of their children, about 316 years before the Chriſtian era.

OLYMPIC GAMES, were ſolemn games among the ancient Greeks, ſo called from Olympian Jupiter, to whom they were dedicated; and by ſome ſaid to be firſt inſtituted by him, after his victory over the ſons of Titan; others aſcribe their inſtitution to Hercules, not the ſon of Alcmena, but one of much greater antiquity; others to Pelops; and others to Hercules the ſon of Alcmena. By whomſoever they were inſtituted, we know that, at a period rather early, they had fallen into diſuſe. The wars which prevailed among the Greeks, for a while, totally interrupted the religious ceremonies and exhibitions with which they had been accuſtomed to honour the common gods and heroes; but the Olympic games were reſtored on the following occaſion. Amidſt the calamities which afflicted or threatened Peloponneſus, Iphitus, a deſcendant of Oxylus, to whom the province of Eleia * had fallen in the general partition of the peninſula, applied to the Delphic oracle. The prieſts of Apollo, ever diſpoſed to favour the views of kings and legiſlators, anſwered agreeably to his wiſh, that the feſtivals anciently celebrated at Olympia, on the Alpheus, muſt be renewed, and an armiſtice proclaimed for all the ſtates willing to partake of them, and deſirous to avert the vengeance of heaven. Fortified by this authority, and aſſiſted by the advice of Lycurgus, Iphitus took meaſures, not only for reſtoring the Olympic ſolemnity, but for rendering it perpetual. The injunction of the oracle was ſpeedily diffuſed through the remoteſt parts of Greece by the numerous votaries who frequented the ſacred ſhrine. The armiſtice was proclaimed in Peloponneſus, and preparations were made in Eleia for exhibiting ſhows and performing ſacrifices. In the heroic ages, feats of bodily ſtrength and addreſs were deſtined to the honour of deceaſed warriors; hymns and ſacrifices were reſerved for the gods: but the flexible texture of Grecian ſuperſtition, eaſily confounding the expreſſions of reſpectful gratitude and pious veneration, enabled Iphitus to unite both in his new inſtitution.

* Gillies Hiſtory of Greece.

The feſtival, which laſted five days, began and ended with a ſacrifice to Olympian Jove. The intermediate time was chiefly filled up by the gymnaſtic exerciſes, in which all freemen of Grecian extraction were invited to contend, provided they had been born in lawful wedlock, and had lived untainted by any infamous immoral ſtain. The preparation for this part of the entertainment was made in the gymnaſium of Elis, a ſpacious edifice, ſurrounded by a double range of pillars, with an open area in the middle. Adjoining were various apartments, containing baths, and other conveniences for the combatants. The neighbouring country was gradually adorned with porticoes, ſhady walks and groves, interſperſed with ſeats and benches; the whole originally deſtined to relieve the fatigues and anxiety of the candidates for Olympic fame; and frequented in later times, by ſophiſts and philoſophers, who were fond to contemplate wiſdom, and communicate knowledge, in thoſe delightful retreats. The order of the athletic exerciſes, or combats, was eſtabliſhed by Lycurgus, and correſponded almoſt exactly to that deſcribed by Homer, in the 23d book of the Iliad, and eighth of the Odyſſey. Iphitus, we are told, appointed the other ceremonies and entertainments; ſettled the regular return of the feſtival at the end of every fourth year, in the month of July; and gave to the whole ſolemnity that form and arrangement, which it preſerved with little variation above a thouſand years; a period exceeding the duration of the moſt famous kingdoms and republics of antiquity. Among the benefactors of Olympia, at a much later period, was reckoned Herod, who was afterwards king of Judæa. Seeing, on his way to Rome, the games neglected or dwindling into inſignificance from the poverty of the Eleans, he diſplayed vaſt munificence as preſident, and provided an ample revenue for their future ſupport and dignity. Olympic.

The care and management of the Olympics belonged for the moſt part to the Eleans; who on that account enjoyed their poſſeſſions without moleſtation, or fear of war or violence. They appointed a certain number of judges, who were to take care that thoſe who offered themſelves as competitors ſhould perform their preparatory exerciſes; and theſe judges, during the ſolemnity, ſat naked, having before them a crown of victory, formed of wild olive, which was preſented to whomſoever they adjudged it. Thoſe who were conquerors were called *Olympionices*, and were loaded with honours by their countrymen. At theſe games women were not allowed to be preſent; and if any woman was found, during the ſolemnity, to have paſſed the river Alpheus, ſhe was to be thrown headlong from a rock. This, however, was ſometimes neglected; for we find not only women preſent at the celebration, but alſo ſome among the combatants, and ſome rewarded with the crown. The preparations for theſe feſtivals were great. No perſon was permitted to enter the liſts, if he had not regularly exerciſed himſelf ten months before the celebration at the public gymnaſium of Elis. No unfair dealings were allowed; whoever attempted to bribe his adverſary was ſubjected to a ſevere fine; and even the father and relations were obliged to ſwear that they would have recourſe to no artifice which might decide the victory in favour of their friends. No criminals, nor ſuch as were connected with impious and guilty perſons, were ſuffered to preſent themſelves as combatants. The wreſtlers were appointed by lot. Some little balls ſuperſcribed with a letter were thrown into a ſilver urn, and ſuch as drew the ſame letter were obliged to contend one with the other. He who had an odd letter remained the laſt; and he often had the advantage, as he was to encounter the laſt who had obtained the ſuperiority over his adverſary. In theſe games were exhibited running, leaping, wreſtling, boxing, and the throwing of the quoit, which was called altogether πενταθλον, or *quinquertium*. Beſides theſe, there were horſe and chariot races, and alſo contentions in poetry, eloquence, and the fine arts. The only reward that the conqueror obtained was a crown of olive. This, as ſome ſuppoſe, was in memory of the labours of Hercules, which were accompliſhed for the univerſal good of mankind, and for which the hero claimed no other reward but the conſciouſneſs of having been the friend of mankind. So ſmall and trifling a reward ſtimulated courage and virtue, and was the ſource of greater

greater honours than the most unbounded treasures. The statues of the conquerors, called *Olympionicæ*, were erected at Olympia in the sacred wood of Jupiter.

Their return home was that of a warlike conqueror; they were drawn in a chariot by four horses, and everywhere received with the greatest acclamations. Their entrance into their native city was not through the gates; to make it more grand and more solemn, a breach was made in the walls. Painters and poets were employed in celebrating their names; and indeed the victories severally obtained at Olympia are the subjects of the most beautiful odes of Pindar. The combatants were naked. A scarf was originally tied round their waist; but when it had entangled one of the adversaries, and been the cause that he lost the victory, it was laid aside, and no regard was paid to decency. The Olympic games were observed every fifth year, or, to speak with greater exactness, after a revolution of four years, and in the first month of the fifth year, and they continued for five successive days. As they were the most ancient and most solemn of all the festivals of the Greeks, it will not appear wonderful, that they drew so many people, not only inhabitants of Greece, but of the neighbouring islands and countries.

Such is the account of Grecian writers, who have, doubtless, often ascribed to positive institution many inventions and usages naturally resulting from the progressive manners of society. When we come to examine the Elean games in their more improved state, together with the innumerable imitations of them in other provinces of Greece, there will occur reasons for believing, that many regulations, referred by an easy solution to the legislative wisdom of Iphitus or Lycurgus, were introduced by time or accident, continued through custom, improved by repeated trials, and confirmed by a sense of their utility †. Yet such an institution as the Olympiad, even in its least perfect form, must have been attended with manifest advantages to society. It is sufficient barely to mention the suspension of hostilities which took place, not only during the celebration of the festival, but a considerable time both before and after it. Considered as a religious ceremony, at which the whole Grecian name was invited, and even enjoined, to assist, it was well adapted to facilitate intercourse, to promote knowledge, to soften prejudice, and to hasten the progress of civilization and humanity. Greece, and particularly Peloponnesus, was the centre from which the adventurous spirit of its inhabitants had diffused innumerable colonies through the surrounding nations. To these widely separated communities, which, notwithstanding their common origin, seemed to have lost all connexion and correspondence, the Olympiad served as a common bond of alliance and point of re-union. The celebrity of this festival continually attracted to it the characters most distinguished for genius and enterprise, whose fame would have otherwise been unknown and lost in the boundless extent of Grecian territory. The remote inhabitants, not only of European Greece, but of Asia and Africa, being assembled to the worship of common gods, were formed to the sense of a general interest, and excited to the pursuit of national honour and prosperity. Strangers of similar dispositions might confirm in Elis the sacred and indissoluble ties of hospitality. If their communities were endangered by any barbarous power, they might here solicit assistance from their Grecian brethren. On other occasions they might explain the benefits which, in peace or war, their respective countries were best qualified to communicate. And the Olympic festival might thus serve the purpose of resident ambassadors, and other institutions alike unknown to antiquity.

† Gillies's History of Greece.



OLYMPUS, the name of several mountains.—One bounding Bithynia on the south.—Another in the island of Cyprus, on whose top was a temple of Venus, which women were not permitted either to enter or to see (Strabo.)—A third, Olympus of Galatia (Livy). —A fourth, of Lycia, with a noble cognominal town, near the sea coast (Strabo, Cicero), extinct in Pliny's time, there remaining only a citadel: the town was destroyed by P. Servilius Isauricus (Florus), having been the retreat of pirates. From this mountain there was an extensive prospect of Lycia, Pamphilia, and Pisidia (Strabo).—A fifth, Olympus of Mysia (Ptolemy); thence surnamed *Olympena*, anciently *Minor*; one of the highest mountains, and surnamed *Mysius* (Theophrastus;) situated on the Propontis, and thence extending more inland.—A sixth, on the north of Thessaly, or on the confines of Macedonia; famous for the fable of the giants (Virgil, Horace, Seneca); reckoned the highest in the whole world, and to exceed the flight of birds (Apuleius), which is the reason of its being called *heaven*, than which nothing is higher: the serenity and calmness which reign there are celebrated by Homer, Lucan, and Claudian.

OLYRA, in botany: A genus of the triandria order, belonging to the monœcia class of plants; and in the natural method ranking under the 4th order, *Gramina*. The male calyx is a biflorous and aristated glume; the corolla a beardless glume; the female calyx is an uniflorous, patulous, and ovate glume; the style is bifid, and the seed cartilaginous.

OMAR (Ebn Al Khattab) successor of Abu Beer. —The Mohammedan imposture, like every other falsehood of its kind, copies after the truth as far as was thought convenient or proper; and miracles being the grand proof of revelation, it was to be expected that all pretences to that should assume at least the appearances of them. Few systems of faith are more absurd than Mohammed's; yet, though he disclaimed miracles, it was supported, as we are told by latter writers, by a variety of them, which, however, unfortunately for the creed they were contrived to support, are too trifling, absurd, and contradictory, to deserve the smallest attention.

They tell us, but upon grounds too vague and indeterminate to command belief, that Omar was miraculously converted to this faith: a man he is reported to have been, before this event, truly respectable, and in particularly a violent opposer of the Arabian prophet. Mohammed, it seems, felt this opposition, and regretted it; he therefore, with the fervour, and, as it happened, with the success of a true prophet, according to his followers account, prayed for the conversion of this his dangerous antagonist. Omar, it is said, had no sooner read the 20th chapter of the Koran than he was convinced: upon which he instantly repaired to Mohammed and his followers, and declared his conversion. It is said, that at one time he intended to murder

 murder the prophet; and various causes are assigned for the prevention of this shocking piece of sacrilege. After his wonderful conversion, the Mohammedan writers inform us that he was surnamed *Al Faruk*, or the "divider;" because, say they, when a certain Moslem was condemned by Mohammed for his iniquitous treatment of a Jew, and appealed afterwards from the sentence of the prophet to Omar, he cut him in two with his scimitar, for not acquiescing in the decision of so upright a judge: which circumstance when Mohammed heard, he gave him the surname of *Al Faruk*, or "the divider;" because, by this action, he had shown himself capable of perfectly distinguishing between truth and falsehood. Al Kodai affirms, that 39 of Omar's adherents followed his example the same day he professed himself a votary of Mohammed. The conversion of Hamza and Omar Ebn Al Khattab happened in the year preceding the first flight of the Moslems into Ethiopia, or the fourth year of Mohammed's mission, according to Abulfeda. He was unquestionably a great acquisition to the prophet, and enabled him to carry on his schemes to far more purpose than he could possibly have done without him, or if he had continued his enemy. Omar at length found his services in the cause he had undertaken sufficiently honoured and amply rewarded; for on the death of Abu Beer, who had succeeded the Impostor himself, he was promoted to the regal and pontifical dignity. The title first assigned him was the *caliph of the caliph of the apostle of God;* or in other words *the successor of the successor of Mohammed:* but the Arabs considering that this title, by the addition to be annexed to it at the accession of every future caliph, would be too long, they, by universal consent, saluted him *the emperor of the believers;* which illustrious title, at this juncture conferred on Omar, descended afterwards to all the successors of that prince. Our readers will not expect us to follow the caliph with minute exactness through the transactions of his reign. This would indeed swell our article beyond all proportion. We shall therefore confine ourselves to some of the leading facts.

His arms appear to have been particularly successful; the Persians he conquered, and Jerusalem submitted to his power; nor does he appear to have been checked in a single instance. In consequence, however, of his success, an attempt was made to assassinate him. The fact is thus related: Wathek Ebn Mosafer, a resolute young Arab, was procured by the king of Ghassan, and sent to Medina for this very purpose. Some time after his arrival, observing Omar to fall asleep under a tree on which he had placed himself, so as not to be discovered by any person, he drew his dagger, and was upon the point of stabbing him, when, lifting up his eyes, he saw a lion walking round about him, and licking his feet. Nor did the lion cease to guard the caliph till he awoke; but then instantly went away. This phenomenon struck Wathek with a profound reverence for Omar, whom he now revered as the peculiar care of heaven. He therefore came down from the tree, on which the lion had forced him to remain, kissed the caliph's hand, confessed his crime, and embraced the Mohammedan religion; being so strongly affected with the wonderful deliverance he had been an eye witness of. His life, however, was at length ended by assassination; for about two years after the conclusion of the Nohawandian war, in which the Arabs probably still farther extended their conquests, though no account of their military operations during that period has reached us, that is, in the 23d year of the Hegira, according to Abu Jaafar Al Tabari, the caliph Omar Ebn Al Khattab was assassinated by a Persian slave; of which horrid fact the Arab writers have handed down the following particulars: Abu Lulua, a Persian of the Magian sect, whose name was *Firuz*, one of Al Mogheira Ebn Al Shaabah's slaves, was obliged by his master to pay daily two dirhems, in conformity to the Mohammedan custom, for the free exercise of this religion. Firuz resenting this treatment, complained of it to the caliph, and desired that some part at least of the tribute exacted of him might be remitted; but this favour being refused by Omar, the Persian threatened his destruction; which he soon after effected, by stabbing him thrice in the belly with a dagger, while he was in the mosque at Medina performing his morning devotions. The Arabs then present perceiving that the villain had imbrued his hands in the blood of their sovereign, immediately rushed upon him; but he made so desperate a defence, that he wounded 13 of the assailants, and seven of them mortally. At last one of the caliph's attendants threw his vest over him, and seized him; upon which he stabbed himself and soon after expired. According to Theophanes, this Firuz was an apostate or renegade, and consequently had before embraced the Mohammedan religion: but this assertion is by no means probable; because on his becoming a convert to Islamism, he must have been manumitted by his master, and on his relapsing into Magism, he would have been put to death by the caliph's order: neither of which particulars are consistent with what we find related by the Arab historians, and even by our Greek chronographer himself. Omar languished three days and then died, in the month of Dhu'lhajja, and the 23d year of the Hegira, which began in the year of our Lord 643. Authors are not agreed with regard to the duration of his caliphate. The Arab historians, whom we are inclined to follow, say that he reigned between 10 and 11 years. Theophanes affirms, that he was murdered in the 12th year of his caliphate, and Dionysius Telmarensis extends the length of his reign to 12 complete years. Only one of the wounds given him by Firuz was mortal, and that he received under his navel. At his death he was 63 years old; which, as we are told by an Arab author, was the age of Mohammed himself, Abu Beer, and Ayesha, one of the prophet's wives, when they died. When Omar fell in the mosque, Abd'alrahman Ebn Awf, one of Mohammed's first converts, supplied his place during the remainder of the service; and three days before his death, Sahib Ebn Tarsib, at his command, officiated for him. His body was interred in Ayesha's apartment, near that of the prophet Mohammed. We are informed by Eutychius, that during his caliphate he performed the pilgrimage to Mecca nine times. His extensive conquests made the Moslem empire one of the most powerful and formidable monarchies in the world. His disposition is represented to us, with evident partiality indeed,

Ombi. as one of the beſt poſſible, and his temperance has always been highly extolled.

OMBI, a city of ancient Egypt, afterwards called *Arſinoe* and *Crocodilopolis*, was the capital of one of the nomes into which that country was divided, and is remarkable, in the annals of idolatry, for the hatred of its inhabitants to the religion of their neighbours the citizens of Tentyra.

The genius of paganiſm was ſo complying with reſpect to the objects of religious worſhip, that although each nation, each city, and almoſt every family, had its own tutelar god, we know not a ſingle inſtance, out of Egypt, of one tribe of Pagans perſecuting another for worſhipping gods different from theirs. The Jews and Chriſtians were indeed perſecuted by the Romans, not however for worſhipping the true God, but becauſe, together with him, they would not worſhip Jupiter, Juno, and all the rabble of heathen divinities.

The reaſon of the almoſt univerſal tolerance of idolaters to one another, and of the intolerance of all to the Jews and Chriſtians, is very obvious. Not a ſingle Pagan, a very few philoſophers perhaps excepted, ever thought of paying his adoration to the Supreme and ſelf-exiſtent Being, but to inferior divinities, to whom it was ſuppoſed that the care of particular perſons, families, cities, and nations was conſigned by the God of the univerſe. The conſequence was, that, as no perſon denied the divinity of his neighbour's object of worſhip, an intercommunity of gods was everywhere admitted, and all joined occaſionally in adoring the gods of the various nations. By the Jews and Chriſtians this communion was rejected as in the higheſt degree impious; and it could not well be maintained between the citizens of Ombi and thoſe of Tentyra.

That brutes were worſhipped in Egypt is univerſally known (See POLYTHEISM); and Diodorus the Sicilian informs us, in a paſſage quoted by Euſebius *, that "the cities and nomes of Egypt being at one time prone to rebellion, and to enter into conſpiracies againſt monarchical government, one of their moſt politic kings contrived to introduce into the neighbouring nomes the worſhip of different animals; ſo that while each reverenced the deity which itſelf held ſacred, and deſpiſed that which its neighbours had conſecrated, they could hardly be brought to join cordially in one common deſign to the diſturbance of the government."

* Prep. Evang. p. 32. Steph. ed.

In this diſtribution of gods he conferred upon Ombi the *crocodile*, and upon Tentyra the mortal enemy of that monſter, the *ichneumon*. The conſequence of which was, that while the Ombites worſhipped the crocodile, the Tentyrites took every opportunity of ſlaughtering him, inſomuch that, according to Strabo, the very voice of an inhabitant of Tentyra put the crocodile to flight. This, we confeſs, is a very improbable fact; but it is certain that the mutual hatred of thoſe cities, on account of their hoſtile gods, roſe to ſuch a height, that whenever the inhabitants of the one were engaged in the more ſolemn rites of their religion, thoſe of the other were ſure to embrace the opportunity of ſetting fire to their houſes, and rendering them every injury in their power to inflict. And what may, to a ſuperficial thinker, appear extraordinary, though it will excite no wonder in the breaſt of him who has ſtudied mankind, this animoſity continued between the inhabitants of the two cities long after the crocodile and ichneumon had loſt their divinity.

Ombre. The conduct of the Egyptian monarch was admirably calculated for preventing the nation from combining againſt the government; and it extended its influence over the whole kingdom. Diodorus informs us, that he aſſigned to each nome an animal to worſhip, which was hated, killed, and ſometimes fed upon by the inhabitants of the neighbouring nome; and we know upon higher authority than his, that the Iſraelites could not offer ſacrifices in Egypt, becauſe the bullock was deemed ſacred over the whole country.

OMBRE, a celebrated game at cards, borrowed from the Spaniards, and played by two, by three, or by five perſons, but generally by three. When three play at this game, nine cards are dealt to each party; the whole ombre pack being only 40; becauſe the eights, nines, and tens, are thrown out of the pack. There are two ſorts of counters for ſtakes, the greater and the leſſer; the laſt having the ſame proportion to the other as a penny to a ſhilling: of the greater counters each man ſtakes one for the game; and one of the leſſer for paſſing for the hand, when eldeſt, and for every card taken in. As to the order and value of the cards, the ace of ſpades, called *ſpadillo*, is always the higheſt trump, in whatſoever ſuit the trump be; the *manille*, or black duce, is the ſecond; and the *baſto*, or ace of clubs, is always the third: the next in order is the king, the queen, the knave, the ſeven, the ſix, the five, four, and three. Of the black there are 11 trumps; of the red, 12. The leaſt ſmall cards of the red are always the beſt, and the moſt of the black; except the duce and red ſeven, both of which are called the *manilles*, and are always ſecond when the red is a trump. The red ace, when a trump, enters into the fourth place, and is called *punto*, otherwiſe it is only called an ace. The three principal cards are called *matadores*; which have this privilege, that they are not obliged to attend an inferior trump when it leads; but for want of a ſmall trump, the perſon may renounce trumps, and play any other card; and when theſe are all in the ſame hand, the others pay three of the greater counters a-piece; and with theſe three for a foundation, he may count as many matadores as he has cards in an uninterrupted ſeries of trumps; for all which the others are to pay one counter a-piece. He who hath the firſt hand is called *ombre*, and has his choice of playing the game, of naming the trump, and of taking in as many and as few cards as he pleaſes; and after him the ſecond, &c. But if he does not name the trump before he looks on the cards he has taken in, any other may prevent him, by naming what trump he pleaſes. He that has the firſt hand ſhould neither take in, nor play, unleſs he has at leaſt three ſure tricks in his hand: for, as he wins the game who wins moſt tricks, he that can win five of the nine has a ſure game; which is alſo the caſe if he wins four, and can ſo divide the tricks as that one perſon may win two, and the other three.

If a perſon plays without diſcarding or changing any cards, this is called *playing ſans prendre*; and if another wins more tricks than he, he is ſaid to *win codille*. The over-ſights in the courſe of the game are called

Ophir.

which tranſlation [illegible] only juſt. But how the Aſſyrians could export [illegible]ry from the iſles of Kittim, and faſhion it into [illegible]ches for the Tyrian mariners, is, in my opinion, [a p]roblem of no eaſy ſolution. The fact is, Aſhurim [sho]uld be Aſherim, that is, the company of the m[illegible] [o]f Aſher. The tribe of Aſher obtained its inh[erit]ance in the neighbourhood of Tyre; (ſee Joſh. xi[x.] 28.) 'And Hebron, and R[eho]b, and Hammon [and] Canah, unto Zidon the great.' The companies [of] the tribe of the Aſherites then, and not the Aſh[uri]m, were the people who manufactured the benche[s in] queſtion.

"[Be] that as it may, the ivory of which theſe implemen[ts] were formed was imported from the iſles of [Kitt]im, that is, from Greece and its neighbourhood. [Th]eſe iſlands, it is certain, never produced ivory. [T]hey muſt therefore have imported it from ſome other country; but no other country, to which the Greeks and their neighbours could have extended their commerce, except the north of Africa, produced that commodity. The concluſion then is, that the maritime ſtates of Aſia Minor, Greece, and probably the Hetruſcans on the weſt coaſt of Italy, carried on a gainful commerce with Spain and Barbary at a very early period.

"We have now ſeen that the original Tarſhiſh on the coaſt of Aſia Minor did not produce the metals imported by Solomon's fleet; that no Tarſhiſh is to be found in the eaſtern parts of the globe; that the Tarſhiſh we are in queſt of was undoubtedly ſituated ſomewhere towards the weſt of Judea: we have ſhown that the mercantile people of Aſia Minor, Greece, and probably of Italy, actually imported ſome of thoſe articles from the coaſt of Africa; we have hazarded a conjecture, that Spain was the modern Tarſhiſh, and that very country from which Solomon imported his ſilver, and the Tyrians their ſilver, iron, tin, and lead. Let us now make a trial whether we cannot exhibit ſome internal proofs in ſupport of the hypotheſis we have above adopted.

"The ancients divided Spain into three parts, Bætica, Luſitania, and Tarraconenſis. Bætica is the modern Andaluſia. It ſtretched along the Fretum Herculeum, or Straits of Gibraltar, to the mouth of the Guadalquiver. This region is thought by ſome to have been the Elyſian Fields of the poets. The river Bætis, which divides it, is called *Tarteſſus* by Ariſtotle, Steſichorus, Strabo, Pauſanias, Steph. Byzant. and Avianus. Here too we have a city and a lake of the ſame name. But Tarteſſus is poſitively the very ſame with Tarſhiſh. The Phœnicians, by changing *ſchin* into *thau*, made it Tartiſh. The Greeks manufactured the reſt, by changing Tartiſh into Tartis, and in proceſs of time into ταρτησσος. That the Phœnicians actually changed *ſchin* into *thau* is certain; for Plutarch tells us in the life of Sylla, that in their language an ox was called *thor*, which is, no doubt, the ſame with the Hebrew *ſhor*.

10 [T]arſhiſh [S]paniſh Bæ-

"From this deduction, it appears highly probable at leaſt, that the Spaniſh Bætica was originally called *Tarſhiſh*. Indeed this ſimilarity of names has operated ſo powerfully on the learned Bochart, and on ſome other moderns of no mean figure, that they have poſitively affirmed, as Joſephus had done before them, that the patriarch Tarſhiſh actually ſettled in that country. This I ſhould think not altogether probable; but that his deſcendants who ſettled on the coaſt of Aſia Minor colonized Bætica, and carried on an uninterrupted commerce to that country, along with the Phœnicians, for many centuries after it was peopled, and that from the circumſtances above narrated, it was denominated *Tarſhiſh*, are facts too palpable to admit of contradiction.

"Let us now ſee whether this Bætica, where I have endeavoured to fix the ſituation of the Tarſhiſh of the Scriptures, was actually furniſhed with thoſe articles of commerce which are ſaid to have been imported from that country. To enlarge on this topic would be altogether ſuperfluous. Diodorus Siculus, Strabo, Polybius, Pliny, Solinus, and, in one word, all the Greek and Roman hiſtorians who have mentioned that region, have unanimouſly exhibited it as the native land of ſilver, iron, and tin: to theſe, contrary to the opinions of the celebrated modern traveller, they likewiſe add gold in very large quantities."

Our author having thus aſcertained the ſituation of Tarſhiſh, proceeds to prove, by a maſs of evidence too large for our inſertion, that the Edomites and Tyrians had doubled the Cape, and almoſt encompaſſed Africa, long before the era of Solomon. Then referring to 1 Kings, chap. ix. and x. 2 Chron. viii. ix. 2 Kings xxii. and 2 Chron. xx. he obſerves, that from theſe authorities it appears indubitable, that the fleets of Solomon and Hiram failed from Eloth and Ezion-geber; that the voyages to Ophir and Tarſhiſh were exactly the ſame, performed at one and the ſame time, by the very ſame fleet; which muſt neceſſarily have encompaſſed the peninſula of Africa before it could arrive at the country of Tarſhiſh. This being the caſe, the traders might eaſily enough collect the gold on the coaſt of Guinea, or on what is now vulgarly called the *Gold Coaſt*. The ivory they might readily enough procure on the Barbary coaſt, oppoſite to Tarſhiſh. In Africa, too, they might hunt apes, monkies, baboons, &c.; and peacocks, or rather parrots, and parroquets, they might ſurpriſe in the foreſts which abounded on the coaſt. In Spain, ſilver, iron, lead, and tin, were, one may ſay, the native produce of the ſoil. Even at this early period, the Phœnician navigators had diſcovered the Caſſiterides, or Scilly iſlands and Cornwall; and from that region, in company with the merchants, may have ſupplied them with that rare commodity.

"I have ſuppoſed that the navy of Solomon and Hiram collected their gold in the courſe of their voyage ſomewhere on the coaſt of Africa, beyond the Cape, for the following reaſons: Had they found the golden fleece at Sofala (A), or any part of the coaſt of Africa, they would have choſen to return and unlade at Eloth or Ezion-geber, rather than purſue a long and dangerous courſe, quite round Africa, to Tarſhiſh; to which laſt country they might have ſhaped their courſe



(A) That Sofala oppoſite to the iſland of Madagaſcar was Ophir, was an ancient conjecture. See Bochart, Chan. L. II. Cap. 27. p. 160. 4to.

course much more commonly from Zidon, Tyre, Joppa, &c. But being obliged to double the Cape in quest of some of these articles which they were enjoined to import, they pushed onward to Tarshish, and returned by the Pillars of Hercules to Tyre, or perhaps to Joppa, &c. Their next voyage commenced from one or other of these ports, from which they directed their course to Tarshish; and having taken in part of their lading there, they afterwards coasted round Africa, and so arrived once more at Eloth or Ezion-geber.

"Let us now attend to the space of time in which these voyages were performed. We are told expressly (2 Chron. ix. 21.) that once every three years came the ships of Tarshish, &c. This is exactly the time one would naturally imagine necessary to perform such a distant voyage, at a period when navigation was still in its infancy, and mariners seldom adventured to lose sight of the coast. Of this we have an irrefragable proof in the history of a voyage round the very same continent, undertaken and accomplished in the very same space of time, about two centuries after.

"We learn from Herodotus, L. II. cap. 149. that of the latter kings of Egypt, whom the Scripture calls *Pharaoh Necho*, built a great number of ships, both on the Red sea and the Mediterranean. The same historian, Lib. IV. cap. 42. informs us, that this enterprising monarch projected a voyage round the the continent of Africa, which was actually accomplished in the space of three years. In the conduct of this enterprise, he employed Phœnician mariners, as Solomon had done before him. These, we may suppose, were assisted in the course of this navigation by charts or journals, or at least by traditional accounts derived from their ancestors: 'These navigators (says the historian) took their departure from a port on the Red sea, and sailing from thence into the southern ocean, and, in the beginning of autumn, landing on the coast of Africa, there they sowed some grain which they had carried out with them on board their vessels. In this place they waited till the crop was ripened; and, having cut it down, they proceeded on their voyage. Having spent two years in this navigation, in the third they returned to Egypt, by the Pillars of Hercules. These mariners, adds the author, reported a fact, which, for [illegible] part, he could by no means believe to be true, namely, that in one part of their course their shadows fell on their right; a circumstance which gives considerable weight to the truth of the relation.

"Let it now be observed, that Phœnician mariners navigated the fleet of Solomon: the same people conducted that of Necho: the fleet of Necho spent three years in the course of its voyage; that of Solomon did the same in its course about two centuries before: the fleet of Necho sailed from a port on the Red sea; that of Solomon took its departure from Eloth or Ezion-geber, situated on the same sea: the fleet of the former returned by the Pillars of Hercules; that of the latter, according to the hypothesis, pursued the very same route. Such a coincidence of similar circumstances united with those adduced in the preceding part of this article, seem to prove almost to a demonstration, that the navy of Hiram and Solomon performed a voyage round Africa, in that age, in the same manner as that of Necho did two centuries after.

"Upon the whole, I conclude, that the original Ophir, which is really Aufir or Aufr, was situated on the south of Arabia Felix, between Sheba and Havilah, which last was encompassed by one of the branches of the river of Paradise: that the name Ophir, i. e. Aufr, was, in consequence of its resemblance, in process of time transferred to a region on the coast of Africa; and that from it first *Afer* and then Africa was denominated: that the primitive Tarshish was Cilicia, and that the Jews applied this name to all the commercial states on the coast of Asia Minor, and perhaps of Italy, there being strong presumptions that the Tyrrhenians were colonists from Tarshish; that Bætica, and perhaps some other regions of Spain, being planted with colonies from Tarshish, likewise acquired the name of Tarshish; that the Tyrians were strictly connected with the merchants of Tarshish in their commercial enterprises; that Tarshish was certainly situated westward from Judea, Phœnicia, &c.; that no other country in the western quarters produced the commodities imported by the two kings, except Spain and the opposite coasts; that this country, in those ages, produced not only silver, iron, tin, and lead, but likewise gold in great abundance; that the merchants of Kittim imported ivory, of which the Asherites made benches for the Tyrians; which commodity they must have purchased on the coast of Barbary, where the Jews and Phœnicians would find the same article; that Tarshish being situated in Spain, it was impossible for a fleet sailing from Eloth or Ezion-geber, to arrive at that country without encompassing Africa; that, of course, the fleet in question did actually encompass that continent; that the Ophir of Solomon must have been situated somewhere on the coast of Africa, to the west of the Cape, because from it the course to Tarshish was more eligible than to return the same way back to Ezion-geber."

11 Ophir situated on the coast of Africa, west of the Cape

Our author supports this conclusion by many other arguments and authorities, which the limits prescribed us will not permit us to detail; but perhaps the article might be deemed incomplete if we did not show how he obviates an objection that will readily occur to his theory. "If the original Ophir was seated on the coast of Arabia Felix, and the modern region of the same name on the west coast of Africa, it may be made a question, how the latter country came to be denominated from the former? Nothing (says our author) can be more easy than to answer this question. The practice of adapting the name of an ancient country to a newly discovered one, resembling the other in appearance, in situation, in figure, in distance, in the nature of the climate, productions, &c. has ever been so common, that to produce instances would be altogether superfluous. The newly discovered region on the coast of Africa abounded with the same species of commodities by which the original one was distinguished; and of course, the name of the latter was annexed to the former."

12 An objection answered.

Whether Mr Bruce's hypothesis, or Dr Doig's, respecting the long disputed situation of Solomon's *Ophir*, be the true one, it is not for us to decide. Both are plausible,

plausible, both are supported [with] much ingenuity and uncommon erudition; but w[e d]o not think that the arguments of either writer [fur]nish a complete confutation of those adduced [by] the other. *Sub judice lis est.*

OPHIRA, in botany: A genus of the monogynia order, belonging to th[e oct]andria class of plants. The involucrum is bivalv[e] and triflorous; the corolla tetrapetalous above; [th]e berry unilocular.

OPHITES, in [n]atural history, a sort of variegated marble, of a dusk[y] green ground, sprinkled with spots of a lighter gree[n,] otherwise called *serpentine.* See the article MARBL[E].

OPHITES, [in] church history, Christian heretics, so called both [fr]om the veneration they had for the serpent that [te]mpted Eve, and the worship they paid to a real ser[p]ent: they pretended that the serpent was Jesus C[hr]ist, and that he taught men the knowledge of goo[d] and evil. They distinguished between *Jesus* and *Christ:* Jesus, they said, was born of the Virgin, but Christ came down from heaven to be united with hi[m]; Jesus was crucified, but Christ had left him to [re]turn to heaven. They distinguished the God of the Jews, whom they termed *Jaldabaoth*, from the supreme God: to the former they ascribed the body, to the latter the soul of men. They had a live serpent, which they kept in a kind of cage; at certain times they opened the cage door, and called the serpent: the animal came out, and mounting upon the table, twined itself about some loaves of bread; this bread they broke and distributed it to the company, who all kissed the serpent: this they called their *Eucharist.*

OPHRYS, TWYBLADE: A genus of the diandria order, belonging to the gynandria class of plants; and in the natural method ranking under the 7th order, *Orchideæ.* The nectarium is a little carinated below. The species are numerous; but the most remarkable are the following:

1. The *ovata, oval-leaved ophrys*, or *common twyblade*, hath a bulbous, fibrated root; crowned by two oval, broad, obtuse, veined, opposite leaves; an erect, succulent, green stalk, six or eight inches high, naked above, and terminated by a loose spike of greenish flowers, having the lip of the nectarium bifid. The flowers of this species resemble the figure of gnats.

2. The *spiralis, spiral orchis*, or *triple ladies tresses*, hath bulbous, oblong, aggregated roots; crowned by a cluster of oval, pointed, ribbed leaves; erect simple stalks, half a foot high; terminated by long spikes of white odoriferous flowers, hanging to one side, having the lip of the nectarium entire, and crenated.

3. The *nidus avis*, or *bird's nest*, hath a bulbous, fibrated, clustered root; upright, thick, succulent stalks, a foot high, sheathed by the leaves, and terminated by loose spikes of pale brown flowers: having the lip of the nectarium bifid.

4. The *anthropophora, man-shaped ophrys*, or *man-orchis*, hath a roundish bulbous root, crowned with three or four oblong leaves; upright thick stalks, rising a foot and a half high; adorned with narrow leaves, and terminated by loose spikes of greenish flowers, representing the figure of a naked man; the lip of the nectarium linear tripartite, with the middle segment longest and bifid. There is a variety with brownish flowers tinged with green.

5. The *insectifera*, or *insect-orchis*, hath two roundish bulbous roots, crowned with oblong leaves; erect leafy stalks, from six to 10 or 12 inches high, terminated by spikes of insect-shaped greenish flowers, having the lip of the nectarium almost five-lobed. This wonderful species exhibits flowers in different varieties, that represent singular figures of flies, bees, and other insects; and are of different colours in the varieties.

6. The *monorchis*, or *musky ophrys*, hath a roundish bulbous root; crowned with three or four oblong leaves; an erect naked stalk, six inches high; terminated by a loose spike of yellowish, musky scented flowers.

All these six species of ophrys flower in summer, at different times in different sorts, from May until July; and in most of the sorts exhibit a singularly curious appearance. The plants are all perennial in root, which are of the bulbous fleshy kind, from which the flower-stalks rise annually in spring, and decay in autumn; at which period is the proper time for removing the roots from one place to another. They all grow wild in Britain, &c.; are residents of woods, bogs, marshy grounds, sterile pastures, chalky soils, and the like places, where they flourish and display their singular flowers in great abundance, from which places they are introduced into gardens for variety; and having procured some plants at the proper season, and planted them in soils and situations somewhat similar to that where they naturally grow, the roots will abide for several years, and flower annually.

As to their propagation, it may be tried by seed in a shady border, as soon as it is ripe; likewise by offsets from the root, though they multiply sparingly in gardens: however, roots of some standing may be examined at the proper season, and any offsets separated and planted in the proper places.

OPHTHALMOSCOPY, a branch of physiognomy, which deduces the knowledge of a man's temper and manner from the appearance of his eyes.

OPHTHALMIA, in medicine, an inflammation of the membranes which invest the eye; especially of the adnata, or albugineous coat. See MEDICINE, N° 175.

OPIATES, medicines of a thicker consistence than a syrup, prepared with opium scarcely fluid. They consist of various ingredients, made up with honey or syrup; and are to be used for a long time either for purgative, alterative, or corroborative intentions.

The word *opiate* is also used, in general, for any medicine given with an intention to procure sleep, whether in the form of electuaries, drops, or pills.

OPINION is that judgment which the mind forms of any proposition for the truth or falsehood of which there is not sufficient evidence to produce science or absolute belief.

That the three angles of a plane triangle are equal to two right angles, is not a matter of *opinion*, nor can it with propriety be called an object of the mathematician's *belief:* he does more than belive it; he *knows* it to be true. When two or three men, under no temptation to deceive, declare that they were witnesses of an uncommon, though not preternatural event, their testimony is complete evidence, and produces absolute *belief* in the minds of those to whom it is given;



 but

Opinion || Opium.

but it does not produce *science* like rigid demonstration. The fact is not doubted, but those who have it on report do not *know* it to be true, as they know the truth of propositions intuitively or demonstrably certain. When one or two men relate a story including many circumstances to a third person, and another comes who positively contradicts it either in whole or in part, he to whom those jarring testimonies are given, weighs all the circumstances in his own mind, balances the one against the other, and lends an assent, more or less wavering, to that side on which the evidence appears to preponderate. This assent is his *opinion* respecting the facts of which he has received such different accounts.

Opinions are often formed of events not yet in being. Were an officer from the combined armies, which are just now † besieging Valenciennes, to come into the room where we are writing, and tell us that those armies are in good health and high spirits; that every shot which they fire upon the fortress produces some effect; and that they have plenty of excellent provisions, whilst the besieged are perishing by hunger; we should absolutely *believe* every fact which he had told us upon the evidence of his testimony; but we could only be of *opinion* that the garrison must soon surrender. In forming opinions of this kind, upon which, in a great measure depends our success in any pursuit, every circumstance should be carefully attended to, and our judgments guided by former experience. Truth is a thing of such importance to man, that he should always pursue the best methods for attaining it; and when the object eludes all his researches, he should remedy the disappointment, by attaching himself to that which has the strongest resemblance to it; and that which most resembles truth is called *probability*, as the judgment which is formed of it is termed *opinion*. See PROBABILITY.

† July 1793.

OPITS, or OPITIUS (Martin), a celebrated German poet, born at Breslaw. He acquired great fame by his Latin, and more by his German poems; and, retiring to Dantzic, wrote a history of the ancient Daci: he died of the plague in 1639.

OPITS (Henry), a learned Lutheran divine, born at Altenburg in Misnia in 1642. He was professor of theology and of the oriental languages at Kiel, where he acquired great reputation by a variety of excellent works concerning oriental literature and Hebrew antiquities. He died in 1712.

OPIUM, in the materia medica, is an inspissated juice, partly of the resinous and partly of the gummy kind, brought to us in cakes from eight ounces to a pound weight. It is very heavy, of a dense texture, and not perfectly dry; but, in general, easily receives an impression from the finger: its colour is a brownish yellow, so very dark and dusky that at first it appears black: it has a dead and faint smell, and its taste is very bitter and acrid. It is to be chosen moderately firm, and not too soft; its smell and taste should be very strong, and care is to be taken that there be no dirty or stony matter in it.

Opium is the juice of the papaver album, or white poppy, with which the fields of Asia Minor are in many places sown, as ours are with corn. When the heads are near ripening, they wound them with an instrument that has h[illegible] edges, which on being stuck into the head makes at once five long cuts in it; and from these wounds the opium flows, and is next day taken off by a person who goes round the field, and put up in a vessel which he carries fastened to his girdle; at the same time that this opium is collected, the opposite side of the poppy head is wounded, and the opium collected from it the next day. They distinguish, however, the produce of the first wounds from that of the succeeding ones; for the first juice afforded by the plant is greatly superior to what is obtained afterwards. After they have collected the opium, they moisten it with a small quantity of water or honey, and work it a long time upon a flat, hard, and smooth board, with a thick and strong instrument of the same wood, till it becomes of the consistence of pitch; and then work it up with their hands, and form it into cakes or rolls for sale.

Opium.

Opium at present is in great esteem, and is one of the most valuable of all the simple medicines. In its effects on the animal system, it is the most extraordinary substance in nature. It touches the nerves as it were by magic and irresistible power, and steeps the sense in forgetfulness; even in opposition to the determined will of the philosopher or physiologist, apprised of its narcotic effect.

*Leake's Essay on the Diseases of the Viscera.*

The modification of matter is infinite; and who shall truly say by what peculiar or specific configuration of its parts, opium, even in the quantity of a single grain, administered to the human body, shall assuage the most raging pain, and procure profound sleep?

The action of matter upon matter, thus exemplified in the effect of opium on the animal system, is not less astonishing and incomprehensible, than that of spirit upon matter, or the agency of mind on the motive powers of the body.

The first effects of opium are like those of a strong, stimulating cordial, but are soon succeeded by universal languor or irresistible propensity to sleep, attended with dreams of the most rapturous and enthusiastic kind. After those contrary effects are over, which are generally terminated by a profuse sweat, the body becomes cold and torpid; the mind pensive and desponding; the head is affected with stupor, and the stomach with sickness and nausea.

It is not our business, neither is it in our power, to reconcile that diversity of opinion which has lately prevailed concerning the manner in which opium produces its effects; or to determine whether it acts simply on the brain and nerves, or, according to the experiments of Fontana, on the mass of blood only.

Opium is the most sovereign remedy in the materia medica, for easing pain and procuring sleep, and also the most certain antispasmodic yet known; but, like other powerful medicines, becomes highly noxious to the human constitution, and even mortal, when improperly administered. Its liberal and long-continued use has been observed greatly to injure the brain and nerves, and to diminish their influence on the vital organs of the body. By its first effects, which are exhilarating, it excites a kind of temporary delirium, which dissipates and exhausts the spirits: and, by its subsequent narcotic power, occasions confusion of ideas and loss of memory, attended with nausea, giddiness, headach,

Opium. headach, and constipation of the bowels; in a word, it seems to suspend or diminish all the natural secretions and excretions of the body, that of perspiration only excepted.

Those who take opium to excess become enervated and soon look old; when deprived of it, they are faint, and experience the languor and dejection of spirits common to such as drink spirituous liquors in excess; to the bad effects of which it is similar, since, like those, they are not easily removed without a repetition of the dose.

By the indiscriminate use of that preparation of opium called *Godfrey's cordial*, many children are yearly cut off; for it is frequently given dose after dose, without moderation, by ignorant women and mercenary nurses, to silence the cries of infants and lull them to sleep, by which they are at last rendered stupid, inactive, and rickety.

Opium is universally known to be used as a luxury in the east. Mr Grose informs us, that most of the hard labouring people at Surat, and especially the porters, take great quantities of this drug, which, they pretend, enables them to work, and carry heavier burdens than they otherwise could do. Some of these, our author assures us, will take more than an ounce at a time without detriment. Many people in opulent circumstances follow the same custom, but with very different motives. Some use it merely for the sake of the pleasing delirium it occasions; others for venereal purposes, as by this means they can lengthen the amorous congress as much as they please, though they thus are certain to bring on an absolute impotency and premature old age at last. For this purpose it is usually taken in milk; and when they have a mind to check or put an end to its operation, they swallow a spoonful or two of lime juice, or any similar acid.

Besides these effects of opium, it is said by the Indians to have a very singular one in bringing on a seeming heaviness of the head and sleepiness of the eye, at the same time that it really produces great watchfulness. It is also considered as a great inspirer of courage, or rather insensibility to danger; so that the commanders make no scruple of allowing large quantities of it to the soldiers when they are going to battle or engaged in any hazardous enterprise.

The best opium in the world is said to come from Patna on the river Ganges, where, at least, the greatest traffic of it is made, and from whence it is exported all over India; though in some parts, especially on the Malay coasts, it is prohibited under pain of death, on account of the madness, and murders consequent upon that madness, which are occasioned by it; notwithstanding which severe prohibition, however, it is plentifully smuggled into all these countries.—The soil about the Ganges is accounted best for producing the strongest kind of opium; of which the following remarkable instance is related. "A nabob of these parts having invited an English factory to an entertainment, a young gentleman, a writer in the Company's service, sauntering about the garden, plucked a poppy and sucked the head of it. In consequence of this he fell into a profound sleep; of which the nabob being apprised, and likewise informed of the particular bed out of which he had taken the flower, expressed his sorrow; acquainting his friends at the same time that the poison was too strong to admit of any remedy; which accordingly proved true, and the unfortunate gentleman never awaked." Opium, Opobalsamum.

Opium applied externally is emollient, relaxing, and discutient, and greatly promotes suppuration: if long kept upon the skin, it takes off the hair, and always occasions an itching in it: sometimes it exulcerates it, and raises little blisters, if applied to a tender part. Sometimes, on external application, it allays pain, and even occasions sleep: but it must by no means be applied to the head, especially to the sutures of the skull; for it has been known to have the most terrible effects in this application, and even to bring on death itself.

*An experimental inquiry into the properties of opium, &c.*

It appears, too, from some curious experiments made by Dr Leigh, to act as the most powerful of all styptics. "Having laid bare the crural artery of a rabbit (says the Doctor), I divided it, when the blood instantly flew out with considerable velocity; some of a strong solution was then applied to the divided artery, the ends of which in a short space of time contracted, and the hæmorrhagy ceased. The same experiment was performed on the brachial artery with like success."

The effects of a strong solution of opium upon the heart, appears from the same experiments to be very extraordinary. "I opened the thorax of a rabbit (says the Doctor), and by dissection placed the heart in full view; the aorta was then divided, and the animal bled till it expired. After the heart had remained motionless ten minutes, and every appearance of life had ceased for the same length of time, I poured on the heart a quantity of my strong solution; it was instantly thrown into motion, which continued two minutes: I then added more of the solution, and the action was again renewed. By thus repeating my applications, the motions of the heart were supported more than ten minutes. I afterwards opened the thorax of a rabbit, and, without doing any injury to the large blood vessels, placed the heart in view. A quantity of my strong solution was then applied to it, which so accelerated the motions as to render it impossible to number them: by renewing the application, these were continued for some considerable time. The surface of the heart now appeared uncommonly red, and continued so some time."

Opium contains gum, resin, essential oil, salt, and earthy matter; but its *narcotic* or somniferous power has been experimentally found to reside in its *essential oil*.

OPOBALSAMUM, in the materia medica. Opobalsam, or balm of Gilead. See AMYRIS.

Mr Bruce, the celebrated traveller, whom we have frequently had occasion to introduce to our readers with that praise to which we think his labours have fully entitled him, employs several pages of his Appendix in ascertaining the antiquity and native soil of the balsam tree, with other particulars of that nature; after which he gives us the following account of the opobalsamum, or juice flowing from it: "At first when it is received into the bottle or vase from the wound from whence it issues, it is of a light yellow colour, apparently turbid, in which there is a whitish cast, which I apprehend are the globules of air that pervade the whole of it in its first state of fermentation; it then appears very light upon shaking. As it settles and cools, it turns clear, and loses that milkiness which

Opobalsamum, Opocalpasum.

it first had when flowing from the tree into the bottle. It then has the colour of honey, and appears more fixed and heavy than at first. After being kept for years, it grows a much deeper yellow, and of the colour of gold. I have some of it, which, as I have already mentioned in my Travels, I got from the cadi of Medina in the 1768; it is now still deeper in colour, full as much so as the yellowest honey. It is perfectly fluid, and has lost very little either of its taste, smell, or weight. The smell at first is violent and strongly pungent, giving a sensation to the brain like to that of volatile salts when rashly drawn up by an incautious person. This lasts in proportion to its freshness; for being neglected, and the bottle uncorked, it quickly loses this quality, as it probably will at last by age, whatever care is taken of it.

"In its pure and fresh state it dissolves easily in water. If dropped on a woollen cloth, it will wash out easily, and leaves no stain. It is of an acrid, rough, pungent taste; is used by the Arabs in all complaints of the stomach and bowels, is reckoned a powerful antiseptic, and of use in preventing any infection of the plague. These qualities it now enjoys, in all probability, in common with the various balsams we have received from the new world, such as the balsam of Tolu, of Peru, and the rest; but it is always used, and in particular esteemed by the ladies as a cosmetic: As such it has kept up its reputation in the east to this very day. The manner of applying it is this: You first go into the tepid bath till the pores are sufficiently opened: you then anoint yourself with a small quantity, and as much as the vessels will absorb. Neverfading youth and beauty are said to be the consequences of this. The purchase is easy enough. I do not hear that it ever has been thought restorative after the loss of either."

OPOCALPASUM, OPOCARBASUM, or APOCALPASUM; a gummy resinous substance, which has a strong resemblance to the best liquid myrrh, and which in the time of Galen they mixed with myrrh. It was difficult, according to this writer, to distinguish the one from the other unless by their effects. It was a poisonous juice, which frequently produced lethargy and sudden strangling. He declares that he has known several persons who died in consequence of inadvertently taking myrrh in which there was a mixture of opocarbasum. Perhaps it was only a juice composed of a solution of euphorbia, in which drops of opium were macerated. Poisons of this kind have from time immemorial been as common in Africa as that of arrows poisoned with the juice of the mancanilla is in America.

Mr Bruce, the Abyssinian traveller, says that he saw in a Mahometan village a large tree, which was so covered with knots and balls of gum on the upper part of the trunk and on the large branches, that it had a monstrous appearance. From some inquiries which he made on this subject, he found that certain merchants had brought this tree from the country of the good myrrh, which is Troglodytria (for it does not grow in Arabia), and that they had planted it for the sake of its gum; with which these Mussulmans starch the blue stuffs of Surat, which they receive damaged from Mocha, in order to barter them with the Galla and the Abyssinians. This tree is called *sassa*; and Mr Bruce declares that he has seen it completely covered with beautiful crimson flowers of a very uncommon structure. The same traveller observes, that the sassa gum is well calculated, both on account of its abundance and its colour, to augment the quantity of myrrh; and he is the more confirmed in his opinion, because every thing leads him to think that no other gummiferous tree, possessed of the same properties with the sassa, grows in the myrrh country. In short, he thinks it almost beyond a doubt that the gum of the sassa tree is the opocalpasum; and he supposes Galen mistaken in ascribing any fatal property to this drug; and that many were believed to be killed by it, whose death might, perhaps, with more justice, have been placed to the account of the physician. Mr Bruce adds, that though the Troglodites of the myrrh country are at present more ignorant than formerly, they are nevertheless well acquainted with the properties of their simples: and that while they wish to increase the sale of their commodities, they would never mix with them a poison which must necessarily diminish it. In this we accede to his opinion; but we must differ from him when he says that no gum or resin with which we are acquainted is a mortal poison: the savages of both hemispheres are acquainted with but too many of them. The gum of the sassa tree, according to Mr Bruce, is of a close smooth grain, of a brown dull colour, but sometimes very transparent; it swells and becomes white in water; it has a great resemblance in its properties to gum tragacanth, and may be eaten with all safety. From all this it appears that the opocalpasum mentioned by Pliny is not the sassa gum described by Mr Bruce.

Opocalpasum, Opopanax.

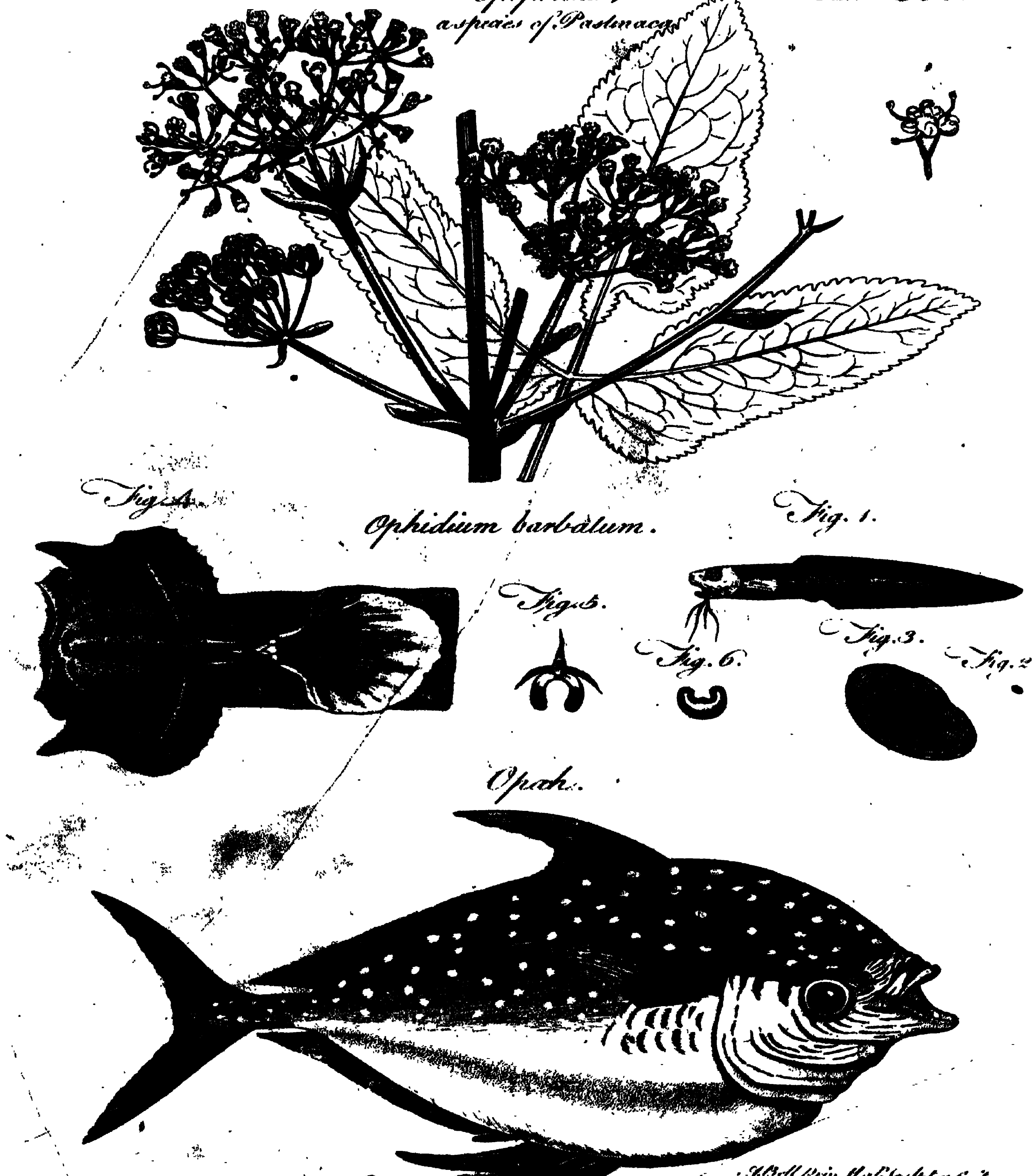
OPOPANAX, in the materia medica, is a gumresin of a tolerably firm texture, usually brought to us in loose granules or drops, and sometimes in large masses, formed of a number of these connected by a quantity of matter of the same kind; but these are usually loaded with extraneous matter, and are greatly inferior to the pure loose kind. The drops or granules of the fine opopanax are on the outside of a brownish red colour, and of a dusky yellowish or whitish colour within: they are of a somewhat unctuous appearance, smooth on the surface; and are to be chosen in clear pieces, of a strong smell and acrid taste.

This gummy substance is obtained from the roots of an umbelliferous plant, which grows spontaneously in the warmer countries, and bears the colds of this. The juice is brought from Turkey and the East Indies; and its virtues are those of an attenuating and aperient medicine. Boerhaave frequently employed it, along with ammoniacum and galbanum, in hypochondriacal disorders, obstructions of the abdominal viscera, and suppressions of the menstrual evacuations from a sluggishness of mucous humours, and a want of due elasticity of the solids: with these intentions it is an useful ingredient in the pilulæ gummosæ and compound powder of myrrh of the London Pharmacopœia, but it is not employed in any composition of the Edinburgh.—It may be given by itself in the dose of a scruple, or half a drachm: a whole drachm proves in many constitutions gently purgative: also dispels flatulencies, is good in asthmas, in inveterate coughs, and in disorders of the head and nerves.

Doctor Woodville, in his Medical Botany, gives the following account of this vegetable: "It is of the *digynia* order, and *pentandria* class of plants: the root is

 perennial,

Plate CCCLI.




A. Bell Prin. Wal. Sculptor fecit.

Opopanax. perennial, thick, fleshy, tapering like the garden parsnep: the stalk is strong, branched rough towards the bottom, and rises seven or eight feet in height; the leaves are pinnated, consisting of several pairs of pinnæ, which are oblong, serrated, veined, and towards the base appear unformed on the upper side: the flowers are small, of a yellowish colour, and terminate the stem and branches in flat umbels; the general and partial umbels are composed of many radii; the general and partial involucra are commonly both wanting; all the florets are fertile, and have an uniform appearance; the petals are five, lance-shaped, and curled inwards; the five filaments are spreading, curved, longer than the petals, and furnished with roundish antheræ; the germen is placed below the corolla, supporting two reflexed styles, which are supplied with blunt stigmata; the fruit is elliptical, compressed, divided into two parts, containing two flat seeds, encompassed with a narrow border. See Plate CCCLI. It is a native of the south of Europe, and flowers in June and July.

"This species of parsnep was cultivated in 1731 by Mr P. Miller, who observes, that its 'roots are large, sweet, and accounted very nourishing,' therefore recommended for cultivation in kitchen gardens. It bears the cold of our climate very well, and commonly maturates its seeds, and its juice here manifests some of those qualities which are discovered in the officinal opopanax; but it is only in the warm regions of the east, and where this plant is a native, that its juice concretes into this gummy resinous drug. Opopanax is obtained by means of incisions made at the bottom of the stalk of the plant, from whence the juice gradually exudes; and by undergoing spontaneous concretion, assumes the appearance under which we have it imported from Turkey and the East Indies. It readily mingles with water, by triture, into a milky liquor, which on standing deposites a portion of resinous matter, and becomes yellowish: to rectified spirit it yields a gold-coloured tincture, which tastes and smells strongly of opopanax. Water distilled from it is impregnated with its smell, but no essential oil is obtained on committing moderate quantities to the operation." See PASTANACA, of which opopanax is a species.

Oporto ‖ Optic.

OPORTO, or PORTO; a rich, handsome, and considerable town of Portugal, in the province of Entre Douro e Minho, with a bishop's see. It is a place of great importance, and by nature almost impregnable. It is noted for its strong wines; and a large quantity is from thence exported into Britain, whence all red wines that come from Spain or Portugal are called *port wines*. It is seated on the declivity of a mountain near the river Duero, which forms an excellent harbour. W. Long. 8. 1. N. Nat. 41. 0.

OPOSSUM, in zoology. See DIDELPHIS.

OPPENHEIM, a town of Germany, in the lower palatinate of the Rhine, and capital of a bailiwick of the same name; seated on the declivity of a hill near the Rhine. E. Long. 8. 20. N. Lat. 49. 48.

OPPIANUS, a poet and grammarian of Anazarba in Cilicia, in the second century. He composed a poem of hunting, and another of fishing, for which Antoninus Caracalla gave him as many golden crowns as there were verses in his poems; they were hence called *Oppian's golden verses*. He died in the 30th year of his age.

OPPILATION, in medicine, the act of obstructing or stopping up the passage of the body, by redundant or peccant humours. This word is chiefly used for obstructions in the lower belly.

OPTATIVE MOOD, in grammar, that which serves to express an ardent desire or wish for something.

In most languages, except the Greek, the optative is only expressed by prefixing to the subjunctive an adverb of wishing: as *utinam*, in Latin; *plut à Dieu*, in French; and *would to God*, in English.

OPTIC ANGLE, the angle which the optic axes of both eyes make with one another, as they tend to meet at some distance before the eyes.

OPTIC *Axis*, the axis of the eye, or a line going through the middle of the pupil and the centre of the eye.

# OPTICS,

THAT science which treats of the element of light, and the various phenomena of vision.

## HISTORY.

### § 1. *Discoveries concerning the Light.*

1 Difficulties attending the explanation of the phenomena of

The element of Light has occupied much of the attention of thinking men ever since the phenomena of nature have been the objects of rational investigation. The discoveries that have from time to time been made concerning it, are so fully inserted under the article LIGHT, that there is little room for any further addition here. The nature of that subtile element is indeed very little known as yet, notwithstanding all the endeavours of philosophers; and whatever side is taken with regard to it, whether we suppose it to consist of an infinity of small particles propagated by a repulsive power from the luminous body, or whether we suppose it to consist in the vibrations of a subtile fluid, there are prodigious difficulties, almost, if not totally insuperable, which will attend the explanation of its phenomena. In many parts of this work the identity of light and of the electric fluid is asserted: this, however, doth not in the least interfere with the phenomena of optics; all of which are guided by the same invariable laws, whether we suppose light to be a vibration of that fluid, or any thing else. We shall therefore proceed to,

### § 2. *Discoveries concerning the Refraction of Light.*

We find that the ancients, though they made very few optical experiments, nevertheless knew, that when light passed through mediums of different densities, it did not move forward in a straight line, but was bent or *refracted*, out of its course. This was probably suggested to them by the appearance of a straight stick partly immersed in water; and we find many questions concerning this and other optical appearances in Aristotle; to which, however, his answers are insignificant. Archimedes is even said to have written a treatise concerning the appearance of a ring or circle under water, and therefore could not have been igno-

2 Refraction known to the ancients;

rant of the common phenomena of refraction. But the ancients were not only acquainted with these more ordinary appearances of refraction, but knew also the production of colours by refracted light. Seneca says, that if the light of the sun shines through an angular piece of glass, it will show all the colours of the rainbow. These colours, however, he says, are false, such as are seen in a pigeon's neck when it changes its position; and of the same nature, he says, is a speculum, which, without having any colour of its own, assumes that of any other body. It appears also, that the ancients were not unacquainted with the magnifying power of glass globes filled with water, though they do not seem to have known any thing of the reason of this power; and the ancient engravers are supposed to have made use of a glass globe filled with water to magnify their figures, and thereby to work to more advantage. That the power of transparent bodies of a spherical form in magnifying or burning was not wholly unknown to the ancients, is further probable from certain gems preserved in the cabinets of the curious, which are supposed to have belonged to the Druids. They are made of rock crystal, of various forms, amongst which are found some that are lenticular and others that are spherical: and though they are not sufficiently wrought to perform their office as well as they might have done if they had been more judiciously executed, yet it is hardly possible that their effect, in magnifying at least, could have escaped the notice of those who had often occasion to handle them; if indeed, in the spherical or lenticular form, they were not solely intended for the purposes of burning. One of these, of the spherical kind, of about an inch and a half diameter, is preserved among the fossils given to the university of Cambridge by Dr Woodward.

3 and the magnifying power of glass globes.

The first treatise of any note written on the subject of optics, was by the celebrated astronomer Claudius Ptolemæus, who lived about the middle of the second century. The treatise is lost; but from the accounts of others we find that he treated of astronomical refractions. Though refraction in general had been observed very early, it is possible that it might not have occurred to any philosopher much before his time, that the light of the sun, moon, and stars, must undergo a similar refraction in consequence of falling obliquely upon the gross atmosphere that surrounds the earth; and that they must, by that means, be turned out of their rectilinear course, so as to cause those luminaries to appear higher in the heavens than they would otherwise do. The first astronomers were not aware that the intervals between stars appear less near the horizon than near the meridian; and, on this account, they must have been much embarrassed in their observations. But it is evident that Ptolemy was aware of this circumstance, by the caution that he gives to allow something for it, upon every recourse to ancient observations.

4 Refraction first treated scientifically by Ptolemy.

This philosopher also advances a very sensible hypothesis to account for the remarkably greater apparent size of the sun and moon when seen near the horizon. The mind, he says, judges of the size of objects by means of a preconceived idea of their distance from us: and this distance is fancied to be greater when a number of objects are interposed between the eye and the body we are viewing; which is the case when we see the heavenly bodies near the horizon. In his Almagest, however, he ascribes this appearance to a refraction of the rays by vapours, which actually enlarge the angle under which the luminaries appear; just as the angle is enlarged by which an object is seen from under water.

5 His hypothesis concerning the horizontal sun and moon.

In the 12th century, the nature of refraction was largely considered by Alhazen an Arabian writer; insomuch that, having made experiments upon it at the common surface between air and water, air and glass, water and glass or crystal; and, being prepossessed with the ancient opinion of crystalline orbs in the regions above the atmosphere, he even suspected a refraction there also, and fancied he could prove it by astronomical observations. This author deduces from hence several properties of atmospherical refraction, as that it increases the altitudes of all objects in the heavens; and he first advanced, that the stars are sometimes seen above the horizon by means of refraction, when they are really below it. This observation was confirmed by Vitellio, B. Waltherus, and especially by the excellent observations of Tycho Brahe. Alhazen observed, that refraction contracts the vertical diameters and distances of the heavenly bodies, and that it is the cause of the twinkling of the stars. But we do not find that either he, or his follower Vitellio, knew any thing of its just quantity. Indeed it is too small to be determined except by very accurate instruments, and therefore we hear little more of it till about the year 1500; at which time great attention was paid to it by Bernard Walther, Mæstlin, and others, but chiefly by Tycho Brahe.

6 Discoveries of Alhazen.

Alhazen supposed that the refraction of the atmosphere did not depend upon the vapours in it, as was probably the opinion of philosophers before his time, but on the different transparency; by which, as Montucla conjectures, he meant the density of the gross air contiguous to the earth, and the ether or subtile air that lies beyond it. In examining the effects of refraction, he endeavours to prove that it is so far from being the cause of the heavenly bodies appearing larger near the horizon, that it would make them appear less; two stars, he says, appearing nearer together in the horizon, than near the meridian. This phenomenon he ranks among optical deceptions. We judge of distance, he says, by comparing the angle under which objects appear, with their supposed distances; so that if these angles be nearly equal, and the distance of one object be conceived greater than that of the other, it will be imagined to be larger. And the sky near the horizon, he says, is always imagined to be further from us than any other part of the concave surface. Roger Bacon ascribes this account of the horizontal moon to Ptolemy; and as such it is examined, and objected to by B. Porta.

In the writings of this Bacon, whose genius perhaps equalled that of his great namesake Lord Verulam, we find the first distinct account of the magnifying power of glasses; and it is not improbable, that what he wrote upon this subject gave rise to that most useful invention of spectacles. For he says, that if an object be applied close to the base of the larger segment of a sphere of glass, it will appear magnified. He also treats of the appearance of an object through a globe, and says that he was the first who observed the refraction of rays into it.

In

7 Of Vitellio.

In 1270, Vitellio, a native of Poland, publiſhed a treatiſe of optics, containing all that was valuable in Alhazen, and digeſted in a much more intelligible and methodical manner. He obſerves, that light is always loſt by refraction, in conſequence of which the objects ſeen by refracted light always appear leſs luminous; but he does not pretend to eſtimate the quantity of this loſs. He reduced into a table the reſult of his experiments on the refractive powers of air, water, and glaſs, correſponding to different angles of incidence. In his account of the horizontal moon he agrees exactly with Alhazen: obſerving, that in the horizon ſhe ſeems to touch the earth, and appears much more diſtant from us than in the zenith, on account of the intermediate ſpace containing a greater variety of objects upon the viſible ſurface of the earth. He aſcribes the twinkling of the ſtars to the motion of the air in which the light is refracted; and to illuſtrate this hypotheſis, he obſerves, that they twinkle ſtill more when viewed in water put in motion. He alſo ſhows, that refraction is neceſſary as well as reflection, to form the rainbow; becauſe the body which the rays fall upon is a tranſparent ſubſtance, at the ſurface of which one part of the light is always reflected and another refracted. But he ſeems to conſider refraction as ſerving only to condenſe the light, and thereby enabling it to make a ſtronger impreſſion upon the eye. This writer makes alſo many ingenious attempts to explain refraction, or to aſcertain the law of it. He alſo conſiders the foci of glaſs ſpheres, and the apparent ſize of objects ſeen through them: though upon theſe ſubjects he is not at all exact. It is ſufficient indeed to ſhow the ſtate of knowledge, or rather of ignorance, at that time, to obſerve, that both Vitellio, and his maſter Alhazen, endeavour to account for objects appearing larger when they are ſeen under water by the circular figure of its ſurface; ſince, being fluid, it conforms to the figure of the earth.

Of Roger Bacon.

Contemporary with Vitellio was Roger Bacon, a man of very extenſive genius, and who wrote upon almoſt every branch of ſcience; yet in this branch he does not ſeem to have made any conſiderable advances beyond what Alhazen had done before him. Even ſome of the wildeſt and moſt abſurd of the opinions of the ancients have had the ſanction of his authority. He does not heſitate to aſſent to an opinion [illegible] many of the ancients, and indeed by moſt [illegible]ers till his time, that viſual rays proceed from the eye; giving this reaſon for it, that every thing in nature is qualified to diſcharge its proper functions by its own powers, in the ſame manner as the ſun and other celeſtial bodies. In his *Specula Mathematica*, he added ſome obſervations on the refraction of the light of the ſtars; the apparent ſize of objects; the extraordinary ſize of the ſun and moon in the horizon: but in all this he is not very exact, and advances but little. In his *Opus Majus* he demonſtrates, that if a tranſparent body interpoſed between the eye and an object, be convex towards the eye, the object will appear magnified. This obſervation, however, he certainly had from Alhazen; the only difference between them is, that Bacon prefers the ſmaller ſegment of a ſphere, and Alhazen the larger, in which the latter certainly was right.

From this time, to that of the revival of learning in Europe, we have no farther treatiſe on the ſubject of refraction, or indeed on any other part of optics. One of the firſt who diſtinguiſhed himſelf in this way was Maurolycus, teacher of mathematics at Meſſina. In a treatiſe, *De Lumine et Umbra*, publiſhed in 1575, he demonſtrates that the cryſtalline humour of the eye is a lens that collects the rays of light iſſuing from the objects and throws them upon the retina where is the focus of each pencil. From this principle he diſcovered the reaſon why ſome people were ſhort-ſighted and others long-ſighted; and why the former are relieved by concave, and the others by convex, glaſſes.

9 Of Maurolycus.

10 Diſcoveries of B. Porta.

About the ſame time that Maurolycus made ſuch advances towards the diſcovery of the nature of viſion, Joannes Baptiſta Porta of Naples diſcovered the *camera obſcura*, which throws ſtill more light on the ſame ſubject. His houſe was conſtantly reſorted to by all the ingenious perſons at Naples, whom he formed into what he called *an academy of ſecrets*; each member being obliged to contribute ſomething that was not generally known, and might be uſeful. By this means he was furniſhed with materials for his *Magia Naturalis*, which contains his account of the *camera obſcura*, and the firſt edition of which was publiſhed, as he informs us, when he was not quite 15 years old. He alſo gave the firſt hint of the magic lantern; which Kircher afterwards followed and improved. His experiments with the *camera obſcura* convinced him, that viſion is performed by the intromiſſion of ſomething into the eye, and not by viſual rays proceeding from the eye, as had been formerly imagined; and he was the firſt, who fully ſatisfied himſelf and others upon this ſubject. Indeed the reſemblance between experiments with the *camera obſcura* and the manner in which viſion is performed in the eye, was too ſtriking to eſcape the obſervation of a leſs ingenious perſon. But when he ſays that the eye is a *camera obſcura*, and the pupil the hole in the window ſhutter, he was ſo far miſtaken as to ſuppoſe that it was the cryſtalline humour that correſponds to the wall which receives the images; nor was it diſcovered till the year 1604, that this office is performed by the retina. He makes a variety of juſt obſervations concerning viſion; and particularly explains ſeveral caſes in which we imagine things to be without the eye, when the appearances are occaſioned by ſome affection of the eye itſelf, or ſome motion within the eye. He obſerves alſo, that, in certain circumſtances, viſion will be aſſiſted by convex or concave glaſſes; and he ſeems alſo to have made ſome ſmall advances towards the diſcovery of teleſcopes. He takes notice, that a round and flat ſurface plunged into water, will appear hollow as well as magnified to an eye perpendicularly over it; and he very well explains by a figure the manner in which it is done.

11 The law of refraction diſcovered.

All this time, however, the great problem concerning the meaſuring of refractions had remained unſolved. Alhazen and Vitellio, indeed, had attempted it; but failed, by attempting to meaſure the angle itſelf inſtead of its ſine. At laſt it was diſcovered by Snellius, profeſſor of mathematics at Leyden. This philoſopher, however, did not perfectly underſtand his own diſcovery, nor did he live to publiſh any account of it himſelf. It was afterwards explained by Profeſſor Hortenſius both publicly and privately before

fore it appeared in the writings of Descartes, who published it under a different form, without making any acknowledgment of his obligations to Snellius, whose papers Huygens assures us, from his own knowledge, Descartes had seen. Before this time Kepler had published a New Table of refracted Angles, determined by his own experiments for every degree of incidence. Kircher had done the same, and attempted a rational or physical theory of refraction, on principles, and on a mode of investigation, which, if conducted with precision, would have led him to the law assumed or discovered by Snellius.

12 Opinions of Descartes and Leibnitz on this subject.

Descartes undertook to explain the cause of refraction by the resolution of forces, on the principles of mechanics. In consequence of this, he was obliged to suppose that light passes with more ease through a dense medium, than through a rare one. The truth of this explanation was first questioned by M. Fermat, counsellor to the parliament of Thoulouse, and an able mathematician. He asserted, contrary to the opinion of Descartes, that light suffers more resistance in water than air, and more in glass than in water; and he maintained, that the resistance of different mediums with respect to light is in proportion to their densities. M. Leibnitz adopted the same general idea; and these gentlemen argued upon the subject in the following manner:—

Nature, say they, accomplishes her ends by the shortest methods. Light therefore ought to pass from one point to another, either by the shortest road, or that in which the least time is required. But it is plain that the line in which light passes, when it falls obliquely upon a denser medium, is not the most direct or the shortest; so that it must be that in which the least time is spent. And whereas it is demonstrable, that light falling obliquely upon a denser medium (in order to take up the least time possible in passing from a point in one medium to a point in the other) must be refracted in such a manner, that the sines of the angles of incidence and refraction must be to one another, as the different facilities with which light is transmitted in those mediums; it follows, that since light approaches the perpendicular when it passes obliquely from air into water, so that the sine of the angle of refraction is less than that of the angle of incidence, the facility with which water suffers light to pass through it is less than that of the air; so that light meets with more resistance in water than air.

13 D[illegible] [illegible] [illegible]stances.

Arguments of this kind could not give satisfaction; [illegible] a little time showed the fallacy of the hypothesis. [illegible]g of the R[illegible]ciety, Aug. 31. 1664, [illegible] experime[illegible]t for measuring the refraction of common [illegible]ter w[illegible] made with a new instrument which they had prepared for that purpose; and, the angle of incidence [illegible] 40 degrees, that of refraction was found to be 30 [illegible] About this time also we find the first mention [illegible]iums not refracting the light in an exact proportion [illegible] densities. For Mr Boyle, in a letter to Mr Oldenburgh, dated Nov. 3. 1664, observes, that in spirit of wine, the proportion of the sines of the angles of incidence to the sines of the angles of refraction was nearly the same as 4 to 3; and that, as spirit of wine occasions a greater refraction than common water, so oil of turpentine, which is lighter than spirit of wine, produces not only a greater refraction than common water, but a much greater than salt water. And at a meeting held Nov. 9. the same year, Dr Hooke (who had been ordered to prosecute the experiment) brought in an account of one that he had made with pure and clear salad oil, which was found to have produced a much greater refraction than any liquor which he had then tried; the angle of refraction that answered to an angle of incidence of 30° being found no less than 40° 30′, and the angle of refraction that answered to an angle of incidence of 20° being 29° 47′.—M. de la Hire also made several experiments to ascertain the refractive power of oil with respect to that of water and air, and found the sine of the angle of incidence to that of refraction to be as 60 to 42; which, he observes, is a little nearer to that of glass than to that of water, though oil is much lighter than water, and glass much heavier.

The members of the Royal Society finding that the refraction of salt water exceeded that of fresh, pursued the experiment farther with solutions of vitriol, saltpetre, and alum, in water; when they found the refraction of the solution of vitriol and saltpetre a little more, but that of alum a little less, than common water.

Dr Hooke made an experiment before the Royal Society, Feb. 11. 1663, which clearly proves that ice refracts the light less than water; which he took to be a good argument that the lightness of ice, which causes it to swim in water, is not caused only by the small bubbles which are visible in it, but that it arises from the uniform constitution or general texture of the whole mass. M. de la Hire also took a good deal of pains to determine whether, as was then the common opinion, the refractive power of ice and water were the same; and he found as Dr Hooke had done before, that ice refracts less than water.

By a most accurate and elaborate experiment made in the year 1698, in which a ray of light was transmitted through a Torricellian vacuum, Mr Lowthorp found, that the refractive power of air is to that of water as 36 to 34,400. He concludes his account of the experiment with observing, that the refractive power of bodies is not proportioned to the density, at least not to the gravity, of the refracting medium. For the refractive power of glass to that of water is as 55 to 34, whereas its gravity is as 87 to 34; that is, the squares of their refractive powers are very nearly as their respective gravities. And there are some fluids, which though they are lighter then water, yet have a greater power of refraction. Thus the refractive power of spirit of wine, according to Dr Hooke's experiment, is to that of water as 36 to 33, and its gravity reciprocally as 33 to 36, or 36¼. But the refractive powers of air and water seem to observe the simple proportion of their gravities directly. And if this should be confirmed by succeeding experiments, it is probable, he says, that the refractive powers of the atmosphere are everywhere, and at all heights above the earth, proportioned to its density and expansion; and then it would be no difficult matter to trace the light through it, so as to terminate the shadow of the earth [illegible], together with proper expedients for measuring the quantity of light illuminating an opaque body, to examine at what distances the moon must be from the earth to suffer eclipses of the observed durations.

Cassini

Caſſini the younger happened to be preſent when Mr Lowthorp made the above-mentioned experiment before the Royal Society; and upon his return home, having made a report of it to the members of the Royal Academy of Sciences, thoſe gentlemen endeavoured to repeat the experiment in 1700; but they did not ſucceed.—For, as they ſaid, beams of light paſſed through the vacuum without ſuffering any refraction. The Royal Society being informed of this, were deſirous that it might be put paſt diſpute, by repeated and well atteſted trials; and ordered Mr Haukſbee to make an inſtrument for the purpoſe, by the direction of Dr Halley. It conſiſted of a ſtrong braſs priſm, two ſides of which had ſockets to receive two plane glaſſes, whereby the air in the priſm might either be exhauſted or condenſed. The priſm had alſo a mercurial gage fixed to it, to diſcover the denſity of the contained air; and was contrived to turn upon its axis, in order to make the refractions equal on each ſide when it was fixed to the end of a teleſcope. The refracting angle was near 64°; and the length of the teleſcope was about 10 feet, having a fine hair in its focus. The event of this accurate experiment was as follows:—

Having choſen a proper and very diſtinct erect object, whoſe diſtance was 2588 feet, June 15. O. S. 1708, in the morning, the barometer being then at 29.7$\frac{1}{4}$, and the thermometer at 60, they firſt exhauſted the priſm, and then applying it to the teleſcope, the horizontal hair in the focus covered a mark on the object diſtinctly ſeen through the vacuum, the two glaſſes being equally inclined to the viſual ray. Then admitting the air into the priſm, the object was ſeen to riſe above the hair gradually as the air entered, and in the end the hair was obſerved to hide a mark 10$\frac{1}{4}$ inches below the former mark. This they often repeated, and with the ſame ſucceſs.

After this they applied the condenſing engine to the priſm; and having forced in another atmoſphere, ſo that the denſity of the included air was double to that of the outward, they again placed it before the teleſcope, and, letting out the air, the object which before ſeemed to riſe, appeared gradually to deſcend, and the hair at length reſted on an object higher than before by the ſame interval of 10$\frac{1}{4}$ inches. This experiment they likewiſe frequently repeated without any variation in the event.

They then forced in another atmoſphere; and upon diſcharging the condenſed air, the object was ſeen near 21 inches lower than before.

Now the radius in this caſe being 2588 feet, 10$\frac{1}{4}$ inches will ſubtend an angle of one minute and 8 ſeconds, and the angle of incidence of the viſual ray being 32 degrees (becauſe the angle of the glaſs planes was 64), it follows from the known laws of refraction, that as the ſine of 39° is to that of 31° 59′ 26″, differing from 32° by 34″ the half of 1′ 8″; ſo is the ſine of any other incidence, to the ſine of its angle of refraction; and ſo is radius, or 1000000, to 999736; which, therefore, is the proportion between the ſine of incidence *in vacuo* and the ſine of refraction from thence into common air.

14 Refractive power of the air determined.

It appears, by theſe experiments, that the refractive power of the air is proportionable to its denſity. And ſince the denſity of the atmoſphere is as its weight directly, and its heat inverſely, the ratio of its denſity, at any given time, may be had by comparing the heights of the barometer and thermometer; and thence he concludes that this will alſo be the ratio of the refraction of the air. But Dr Smith obſerves, that, before we can depend upon the accuracy of this concluſion, we ought to examine whether heat and cold alone may not alter the refractive power of air, while its denſity continues the ſame. This, he ſays, may be tried, by heating the condenſed or rarefied air, ſhut up in the priſm, juſt before it is fixed to the teleſcope, and by obſerving whether the hair in its focus will continue to cover the ſame mark all the while that the air is cooling.

The French academicians, being informed of the reſult of the above-mentioned experiment, employed M. De l'Iſle the younger to repeat the ſame experiment with more care; and he preſently found, that their operators had never made any vacuum at all, there being chinks in their inſtrument, through which the air had inſinuated itſelf. He therefore annexed a gage to his inſtrument, by which means he was ſure of his vacuum; and then the reſult of the experiment was the ſame with that in England. The refraction was always in proportion to the denſity of the air, excepting when the mercury was very low, and conſequently the air very rare; in which caſe the whole quantity being very ſmall, he could not perceive much difference in them. Comparing, however, the refractive power of the atmoſphere, obſerved at Paris, with the reſult of his experiment, he found, that the beſt vacuum he could make was far ſhort of that of the etherial regions above the atmoſphere.

Dr Hooke firſt ſuggeſted the thought of making allowance for the effect of the refraction of light, in paſſing from the higher and rarer, to the lower and denſer regions of the atmoſphere, in the computed height of mountains. To this he aſcribes the different opinions of authors concerning the height of ſeveral very high hills. He could not account for the appearance of the Peak of Teneriffe, and ſeveral very high mountains, at ſo great a diſtance as that at which they are actually ſeen, but upon the ſuppoſition of the curvature of the viſual ray, that is made by its paſſing obliquely through a medium of ſuch different denſity, from the top of them to the eye, very far diſtant in the horizon. All calculations of the height of mountains that are made upon the ſuppoſition that the rays of light come from the tops of them, to our eyes, in ſtraight lines, muſt, he ſays, be very erroneous.

Dr Hooke gives a very good account of the twinkling of the ſtars; aſcribing it to the irregular and unequal refraction of the rays of light, which is alſo the reaſon why the limbs of the ſun, moon, and planets, appear to wave or dance. And that there is ſuch an unequal diſtribution of the parts of the atmoſphere, he ſays, is manifeſt from the different degrees of heat and cold in the air. This, he ſays, will be evident by looking upon diſtant objects, over a piece of hot glaſs, which cannot be ſuppoſed to throw out any kind of exhalation from itſelf, as well as through aſcending ſteams of water.

About this time Grimaldi firſt obſerved that the coloured image of the ſun refracted through a priſm is

15 Colours discovered to arise from refraction.

always oblong, and that colours proceed from refraction.—The way in which he first discovered this was by Vitellio's experiment above mentioned, in which a piece of white paper placed at the bottom of a glass vessel filled with water, and exposed to the light of the sun, appears coloured. However, he observed, that in case the two surfaces of the refracting medium were exactly parallel to each other, no colours were produced. But of the true cause of those colours, viz. the different refrangibility of the rays of light, he had not the least suspicion. This discovery was reserved for Sir Isaac Newton, and which occurred to him in the year 1666. At that time he was busied in grinding optic glasses, and procured a triangular glass prism to satisfy himself concerning the phenomena of colours. While he amused himself with this, the oblong figure of the coloured spectrum first struck him. He was surprised at the great disproportion betwixt its length and breadth; the former being about five times the measure of the latter. He could hardly think that any difference in the thickness of the glass or in the composition of it, could have such an influence on the light. However, without concluding any thing *à priori*, he proceeded to examine the effects of these circumstances, and particularly tried what would be the consequence of transmitting the light through parts of the glass that were of different thicknesses, or through holes in the window-shutter of different sizes; or by setting the prism on the outside of the shutter, that the light might pass through it, and be refracted before it was terminated by the hole.

16 Different refrangibility of the rays of light discovered by Sir Isaac Newton.

He then suspected that these colours might arise from the light being dilated by some unevenness in the glass, or some other accidental irregularity; and to try this, he took another prism like the former, and placed it in such a manner, as that the light, passing through them both, might be refracted contrariwise, and so be returned by the latter into the same course from which it had been diverted by the former. In this manner he thought that the regular effects of the first prism would be destroyed by the second; but that the irregular ones would be augmented by the multiplicity of refractions. The event was, that the light, which by the first prism was diffused into an oblong form, was by the second reduced into a circular one, with as much regularity as if it had not passed through either of them.

At last, after various experiments and conjectures, he hit upon what he calls the *experimentum crucis*, and which completed this great discovery. He took two boards, and placed one of them close behind the prism at the windows, so that the light might pass through a small hole made in it for the purpose, and fall on the other board, which he placed at the distance of about twelve feet; having first made a small hole in it also, for some of that incident light to pass through. He then placed another prism behind the second board, so that the light which was transmitted through both the boards might pass through that also, and be again refracted before it arrived at the wall.—This being done, he took the first prism in his hand, and turned it about its axis, so much as to make the several parts of the image cast on the second board, successively to pass through the hole in it, that he might observe to what places on the wall the second prism would refract them; and he saw, by the change of those places, that the light tending to that end of the image towards which the refraction of the first prism was made, did, in the second prism, suffer a refraction considerably greater than the light which tended to the other end. The true cause, therefore, of the length of the image was discovered to be no other, than that light is not similar, or homogeneal; but that it consists of rays, some of which are more refrangible than others: so that, without any difference in their incidence on the same medium, some of them shall be more refracted than others; and therefore, that, according to their particular degrees of refrangibility, they will be transmitted through the prism to different parts of the opposite wall.

Since it appears from these experiments that different rays of light have different degrees of refrangibility, it necessarily follows, that the rules laid down by preceding philosophers concerning the refractive power of water, glass, &c. must be limited to the middle kind of rays. Sir Isaac, however, proves that the sine of the incidence of every kind of light, considered apart, is to its sine of refraction in a given ratio. This he deduces, both by experiment, and also geometrically, from the supposition that bodies refract the light by acting upon its rays in lines perpendicular to their surfaces.

17 Mr Dollond's discovery of the method of correcting the faults in refracting telescopes.

The most important discovery with regard to refraction since the time of Sir Isaac Newton is that of Mr Dollond, who found out a method of curing the faults of refracting telescopes arising from the different refrangibility of the rays, and which had been generally thought impossible to be removed. Notwithstanding the great discovery of Sir Isaac Newton concerning the different refrangibility of the rays of light, he had no idea but that they were all affected in the same proportion by every medium, so that the refrangibility of the extreme rays might be determined if that of the mean ones was given. From this it would follow, as Mr Dollond observes, that equal and contrary refractions must not only destroy each other, but that the divergency of the colours from one refraction would likewise be corrected by the other, and that there could be no possibility of producing any such thing as refraction which would not be affected by the different refrangibility of light; or, in other words, that however a ray of light might be refracted backwards and forwards by different mediums, as water, glass, &c. provided it was so done, that the emergent ray should be parallel to the incident one, it would ever after be white; and consequently, if it should come out inclined to the incident, it would diverge, and ever after be coloured; and from this it was natural to infer, that all spherical object glasses of telescopes must be equally affected by the different refrangibility of light, in proportion to their apertures, of whatever materials they may be formed.

For this reason, Sir Isaac Newton, and all other philosophers and opticians, had despaired of bringing refracting telescopes to any great degree of perfection, without making them of an immoderate and very inconvenient length. They therefore applied themselves chiefly to the improvement of the reflecting telescope; and the business of refraction was dropped till about

about the year 1747, when M. Euler, improving upon a hint of Sir Isaac Newton's, formed a scheme of making object glasses of two materials, of different refractive powers; hoping, that by this difference, the refractions would balance one another, and thereby prevent the dispersion of the rays that is occasioned by the difference of refrangibility. These object glasses were composed of two lenses of glass with water between them. This memoir of M. Euler excited the attention of Mr Dollond. He carefully went over all M. Euler's calculations, substituting for his hypothetical laws of refraction those which had been actually ascertained by the experiments of Newton; and found, that, after this necessary substitution, it followed from M. Euler's own principles, that there could be no union of the foci of all kinds of colours, but in a lens infinitely large.

M. Euler did not mean to controvert the experiments of Newton: but he said, that they were not contrary to his hypothesis, but in so small a degree as might be neglected; and asserted, that, if they were admitted in all their extent, it would be impossible to correct the difference of refrangibility occasioned by the transmission of the rays from one medium into another of different density; a correction which he thought was very possible, since he supposed it to be actually effected in the structure of the eye, which in his opinion was made to consist of different mediums for that very purpose. To this kind of reasoning Mr Dollond made no reply, but by appealing to the experiments of Newton, and the great circumspection with which it was known that he conducted all his inquiries.

In this state of the controversy, the friends of M. Clairaut engaged him to attend to it; and it appeared to him, that, since the experiments of Newton cited by Mr Dollond could not be questioned, the speculations of M. Euler were more ingenious than useful.

The same paper of M. Euler was also particularly noticed by M. Klingenstierna of Sweden, who gave a considerable degree of attention to the subject, and discovered, that, from Newton's own principles, the result of the 8th experiment of the second book of his Optics could not answer his description of it.

He fo[illegible] he says, that when light goes out of air throu[illegible] contiguous refracting mediums, as through water and glass, and thence goes out again into air, whether the refracting surfaces be parallel or inclined to one another, that light, as often as by contrary refractions it is so corrected as to emerge in lines parallel to those in which it was incident, continues ever after to be white; but if the [illegible]nt rays be inclined to the incident, the whiteness of the emerging light will, by degrees, in passing on from the place of emergence, become tinged at its edges with colours. This he tried by refracting light with prisms of glass, placed within a prismatic vessel of water.

By theorems deduced from this experiment he infers, that the refractions of the rays of *every* sort, made out of any medium into air, are known by having the refraction of the rays of *any one* sort; and also that the refraction out of one medium into another is found as often as we have the refractions out of them both into any third medium.

On the contrary, the Swedish philosopher observes, that, in this experiment, the rays of light, after passing through the water and the glass, though they come out parallel to the incident rays, will be coloured; but that the smaller the glass prism is, the nearer will the result of it approach to Newton's description.

This paper of M. Klingenstierna being communicated to Mr Dollond by M. Mallet, made him entertain doubts concerning Newton's report, and determined him to have recourse to experiment.

He therefore cemented together two plates of parallel glass at their edges, so as to form a prismatic vessel, when stopped at the ends or bases; and the edge being turned downwards, he placed in it a glass prism, with one of its edges upwards, and filled up the vacancy with clear water; so that the refraction of the prism was contrived to be contrary to that of the water, in order that a ray of light, transmitted through both these refracting mediums, might be affected by the difference only between the two refractions. As he found the water to refract more or less than the glass prism, he diminished or increased the angle between the glass plates, till he found the two contrary refractions to be equal; which he discovered by viewing an object through this double prism. For when it appeared neither raised or depressed, he was satisfied that the refractions were equal, and that the emergent rays were parallel to the incident.

Now, according to the prevailing opinion, he observes, the object should have appeared through this double prism in its natural colour; for if the difference of refrangibility had been in all respects equal in the two equal refractions, they would have rectified each other. But this experiment fully proved the fallacy of the received opinion, by showing the divergency of the light by the glass prism to be almost double of that by the water; for the image of the object, though not at all refracted, was yet as much infected with prismatic colours, as if it had been seen through a glass wedge only, whose refracting angle was near 30 degrees.

This experiment is the very same with that of Sir Isaac Newton's above-mentioned, notwithstanding the result was so remarkably different; but Mr Dollond assures us, that he used all possible precaution and care in hi[illegible]; and he kept his apparatus by him, that [illegible]t evince the truth of what he wrote, whenever he should be properly required to do it.

He plainly saw, however, that if the refracting angle of the water vessel could have admitted of a sufficient increase, the divergency of the coloured rays would have been greatly diminished, or entirely rectified; and that there would have been a very great refraction without colour, as he had already produced a great discolouring without refraction: but the inconveniency of so large an angle as that of the prismatic vessel must have been, to bring the light to an equal divergency with that of the glass prism whose angle was about 60 degrees, made it necessary to try some experiments of the same kind with smaller angles.

Accordingly, he got a wedge of plate glass, the angle of which was only nine degrees; and using it in the same circumstances, he increased the angle of the water

water wedge, in which it was placed, till the divergency of the light by the water was equal to that by the glass; that is, till the image of the object, though considerably refracted by the excess of the refraction of the water, appeared nevertheless quite free from any colours proceeding from the different refrangibility of the light; and as near as he could then measure, the refraction by the water was about $\frac{3}{4}$ of that by the glass. He acknowledges, indeed, that he was not very exact in taking the measures, because his business was not at that time to determine the exact proportions, so much as to show that the divergency of the colours, by different substances, was by no means in proportion to the refractions, and that there was a possibility of refraction without any divergency of the light at all.

As these experiments clearly proved, that different substances made the light to diverge very differently in proportion to their general refractive power, Mr Dollond began to suspect that such variety might possibly be found in different kinds of glass, especially as experience had already shown that some of the kinds made much better object glasses in the usual way than others; and as no satisfactory cause had been assigned for such difference, he thought there was great reason to presume that it might be owing to the different divergency of the light in the same refractions.

His next business, therefore, was to grind wedges of different kinds of glass, and apply them together; so that the refractions might be made in contrary directions, in order to discover, as in the above-mentioned experiments, whether the refraction and the divergency of the colours would vanish together. But a considerable time elapsed before he could set about that work: for though he was determined to try it at his leisure, for satisfying his own curiosity, he did not expect to meet with a difference sufficient to give room for any great improvement of telescopes, so that it was not till the latter end of the year 1757 that he undertook it; but his first trials convinced him that the business deserved his utmost attention and application.

He discovered a difference far beyond his hopes in the refractive qualities of different kinds of glass, with respect to the divergency of colours. The yellow or straw-coloured foreign sort, commonly called *Venice glass*; and the *English crown glass*, proved to be very nearly alike in that respect; though, in general, the crown glass seemed to make the light diverge the less of the two. The common English plate glass made the light diverge more; and the white crystal, or English flint glass, most of all.

It was now his business to examine the particular qualities of every kind of glass that he could come at, not to amuse himself with conjectures about the cause of this difference, but to fix upon two sorts in which it should be the greatest; and he soon found these to be the crown glass and the white flint glass. He therefore ground one wedge of white flint, of about 25 degrees; and another of crown glass, of about 29 degrees: which refracted very nearly alike, but their power of making the colours diverge was very different. He then ground several others of crown glass to different angles, till he got one which was equal, with respect to the divergency of the light, to that in the white flint glass: for when they were put together, so as to refract in contrary directions, the refracted light was entirely free from colours. Then measuring the refraction of each wedge with these different angles, he found that of the white glass to be to that of the crown glass nearly as two to three: and this proportion held very nearly in all small angles; so that any two wedges made in this proportion, and applied together, so as to refract in a contrary direction, would refract the light without any dispersion of the rays.

In a letter to M. Klingenstierna, quoted by M. Clairaut, Mr Dollond says, that the sine of incidence in crown glass is to that of its general refraction as 1 to 1.53, and in flint glass as 1 to 1.583.

To apply this knowledge to practice, Mr Dollond went to work upon the object glasses of telescopes; not doubting but that, upon the same principles on which a refracted colourless ray was produced by prisms, it might be done by lenses also, made of similar materials. And he succeeded, by considering, that, in order to make two spherical glasses that should refract the light in contrary directions, the one must be concave and the other convex; and as the rays are to converge to a real focus, the excess of refraction must evidently be in the convex lens. Also, as the convex glass is to refract the most, it appeared from his experiments, that it must be made of crown glass, and the concave of white flint glass. Farther, As the refractions of spherical glasses are in an inverse ratio of their focal distances, it follows, that the focal distances of the two glasses shall be inversely as the ratios of the refractions of the wedges; for being thus proportioned, every ray of light that passes through this combined glass, at whatever distance it may pass from its axis, will constantly be refracted, by the difference between two contrary refractions, in the proportion required; and therefore the different refrangibility of the light will be entirely removed.

Notwithstanding our author had these clear grounds in theory and experiment to go upon, he found that he had many difficulties to struggle with when he came to reduce them into actual practice; but with great patience and address, he at length got into a ready method of making telescopes upon these new principles.

His principal difficulties arose from the following circumstances. In the first place, The focal distances, as well as the particular surfaces, must be very nicely proportioned to the densities or refracting powers of the glasses, which are very apt to vary in the same sort of glass made at different times. Secondly, The centres of the two glasses must be placed truly in the common axis of the telescope, otherwise the desired effect will be in a great measure destroyed. Add to these, that there are four surfaces to be wrought perfectly spherical; and any person, he says, but moderately practised in optical operations, will allow, that there must be the greatest accuracy throughout the whole work. At length, however, after numerous trials, and a resolute perseverance, he was able to construct refracting telescopes, with such apertures and magnifying powers, under limited lengths, as, in the opinion of the best judges, far exceeded any thing that had been produced

duced before, repreſenting objects with great diſtinctneſs, and in their true colours.

It was objected to Mr Dollond's diſcovery, that the ſmall diſperſion of the rays in crown glaſs is only apparent, owing to the opacity of that kind of glaſs, which does not tranſmit the fainter coloured rays in a ſufficient quantity; but this objection is particularly conſidered, and anſwered by M. Beguelin.

As Mr Dollond did not explain the methods which he took in the choice of different ſpheres proper to deſtroy the effect of the different refrangibility of the rays of light, and gave no hint that he himſelf had any rule to direct himſelf in it; and as the calculation of the diſperſion of the rays, in ſo complicated an affair, is very delicate; M. Clairaut, who had given a good deal of attention to this ſubject, from the beginning of the controverſy, endeavoured to make out a complete theory of it.

Without ſome aſſiſtance of this kind, it is impoſſible, ſays this author, to conſtruct teleſcopes of equal goodneſs with thoſe of Mr Dollond, except by a ſervile imitation of his; which, however, on many accounts, would be very unlikely to anſwer. Beſides, Mr Dollond only gave his proportions in general, and pretty near the truth; whereas the greateſt poſſible preciſion is neceſſary. Alſo the beſt of Mr Dollond's teleſcopes were far ſhort of the Newtonian ones (A); whereas it might be expected that they ſhould exceed them, if the foci of all the coloured rays could be as perfectly united after refraction through glaſs, as after reflection from a mirror; ſince there is more light loſt in the latter caſe than in the former.

With a view, therefore, to aſſiſt the artiſt, he endeavoured to aſcertain the refractive power of different kinds of glaſs, and alſo their property of ſeparating the rays of light by the following exact methods. He made uſe of two priſms placed cloſe to one another, as Mr Dollond had done: but, inſtead of looking through them, he placed them in a darkened room; and when the image of the ſun, tranſmitted through them, was perfectly white, he concluded that the different refrangibility of the rays was corrected.

In order to aſcertain with more eaſe the true angles that priſms ought to have to deſtroy the effect of the difference of refrangibility, he conſtructed one which had one of its ſurfaces cylindrical, with ſeveral degrees of amplitude. By this means, without changing his priſms, he had the choice of an infinity of angles; among which, by examining the point of the curve ſurfac[illegible] whic[illegible] [illegible]ceiving the ſolar ray, gave a white image, he [illegible]ld eaſily find the true one.

He alſo aſcertained the proportion in which [illegible]ent kinds of glaſs ſeparated the rays of light, by meaſuring, with proper precautions, the oblong image of the ſun made by tranſmitting a beam of light through them. In making theſe experiments, he hit upon an eaſy method of convincing any perſon of the greater refractive power of Engliſh flint glaſs above the common French glaſs, both with reſpect to the mean refraction, and the different refrangibility of the colours; for having taken two priſms, of theſe two kinds of glaſs, but equal in all other reſpects, and placed them ſo that they received, at the ſame time, two rays of the ſun, with the ſame degree of incidence, he ſaw, that of the two images, that which was produced by the Engliſh flint glaſs was a little higher up on the wall than the other, and longer by more than one half.

M. Clairaut was aſſiſted in theſe experiments by M. De Tournieres, and the reſults agreed with Mr Dollond's in general; but whereas Mr Dollond had made the diſperſion of the rays in glaſs and in water to be as five to four (acknowledging, however, that he did not pretend to do it with exactneſs), theſe gentlemen, who took more pains, and uſed more precautions, found it to be as three to two. For the theorems and problems deduced by M. Clairaut from theſe new principles of optics, with a view to the perfection of teleſcopes, we muſt refer the reader to *Mem. Acad. Par.* 1756, 1757.

The labours of M. Clairaut were ſucceeded by thoſe of M. D'Alembert, which ſeem to have given the makers of theſe achromatic teleſcopes all the aid that calculations can afford them. This excellent mathematician has likewiſe propoſed a variety of new conſtructions of theſe teleſcopes, the advantages and diſadvantages of which he diſtinctly notes; at the ſame time that he points out ſeveral methods of correcting the errors to which they are liable: as by placing the object glaſſes, in ſome caſes, at a ſmall diſtance from one another, and ſometimes by uſing eye glaſſes of different refractive powers; which is an expedient that ſeems not to have occured to any perſon before him. He even ſhows, that teleſcopes may be made to advantage, conſiſting of only one object glaſs, and an eye glaſs of a different refractive power. Some of his conſtructions have two or more eye glaſſes of different kinds of glaſs. This ſubject he conſidered at large in one of the volumes of his *Opuſcules Mathematiques.* We have alſo three memoirs of M. D'Alembert upon this ſubject, among thoſe of the French Academy; one in the year 1764, another in 1765, and a third in 1767.

At the concluſion of his ſecond memoir he ſays, that he does not doubt, but, by the different methods he propoſes, achromatic teleſcopes may be made to far greater degrees of perfection than any that have been ſeen hitherto, and even ſuch as is hardly credible: And though the crown glaſs, by its greeniſh colour, may abſorb ſome part of the red or violet rays, which, however, is not found to be the caſe in fact; that objection cannot be made to the common French glaſs, which is white, and which on this account he thinks muſt be preferable to the Engliſh crown glaſs.

Notwithſtanding Meſſrs Clairaut and D'Alembert ſeemed to have exhauſted the buſineſs of calculation on the ſubject of Mr Dollond's teleſcopes, no uſe could be made of their labours by foreign artiſts. For ſtill the teleſcopes made in England, according to no exact rule,

(A) This aſſertion of M. Clairaut might be true at the time that it was made, but it is by no means ſo at preſent.

rule, as foreigners supposed, were greatly superior to any that could be made elsewhere, though under the immediate direction of those able calculators. For this M. Beguelin assigned several reasons. Among others, he thought that their geometrical theorems were too general, and their calculations too complicated, for the use of workmen. He also thought, that in consequence of neglecting small quantities, which these calculators professedly did, in order to make their algebraical expressions more commodious, their conclusions were not sufficiently exact. But what he thought to be of the most consequence, was the want of an exact method of measuring the refractive and dispersing powers of the different kinds of glass; and for want of this, the greatest precision in calculation was altogether useless.

These considerations induced this gentleman to take another view of this subject; but still he could not reconcile the actual effect of Mr Dollond's telescopes with his own conclusions: so that he imagined, either that he had not the true refraction and dispersion of the two kinds of glass given him; or else, that the aberration which still remained after his calculations, must have been destroyed by some irregularity in the surfaces of the lenses. He finds several errors in the calculations both of M. D'Alembert and Clairaut, and concludes with expressing his design to pursue this subject much farther.

M. Euler, who first gave occasion to this inquiry, which terminated so happily for the advancement of science, being persuaded both by his reasoning and calculations, that Mr Dollond had discovered no new principle in optics, and yet not being able to controvert Mr Short's testimony in favour of the goodness of his telescopes, concluded that this extraordinary effect was owing, in part, to the crown glass not transmitting all the red light, which would otherwise have come to a different focus, and have distorted the image; but principally to his happening to hit on a just curvature of his glass, which he did not doubt would have produced the same effect if his lenses had all been made of the same kind of glass. In another place he imagines that the goodness of Mr Dollond's telescope might be owing to the eye glass. If my theory, says he, be true, this disagreeable consequence follows, that Mr Dollond's object glasses cannot be exempt from the dispersion of colours: yet a regard to so respectable a testimony embarrasses me extremely, it being as difficult to question such express authority, as to abandon a theory which appears to me perfectly well founded, and to embrace an opinion, which is as contrary to all the established laws of nature as it is strange and seemingly absurd. He even appeals to experiments made in a darkened room; in which, he says, he is confident that Mr Dollond's object-glasses would appear to have the same defects that others are subject to.

Not doubting, however, but that Mr Dollond, either by chance, or otherwise, had made some considerable improvement in the construction of telescopes, by the combination of glasses, he abandoned his former project, in which he had recourse to different mediums, and confined his attention to the correction of the errors which arise from the curvature of lenses. But while he was proceeding, as he imagined, upon the true principles of optics, of which, however, he made but little use, he could not help expressing his surprise that Mr Dollond should have been led to so important a discovery by reasoning in a manner quite contrary to the nature of things. At length, however, M. Euler was convinced of the reality and importance of Mr Dollond's discoveries; and very frankly acknowledges, that he should perhaps never have been brought to assent to it, had not his friend M. Clairaut assured him that the experiments of the English optician might be depended upon. However, the experiments of M. Zeiher of Petersburgh gave him the most complete satisfaction with respect to this new law of refraction.

This gentleman demonstrated, that it is the lead in the composition of glass that gives it this remakable property, that while the refraction of the mean rays is nearly the same, that of the extremes differs considerably. And, by increasing the quantity of lead in the mixture, he produced a kind of glass, which occasioned a much greater separation of the extreme rays than the flint glass which Mr Dollond had made use of. By this evidence M. Euler owns that he was compelled to renounce the principle which, before this time, had been considered as incontestable, *viz.* that the dispersion of the extreme rays depends upon the refraction of the mean: and that the former varies with the quality of the glass, while the latter is not affected by it.

From these new principles M. Euler deduces theorems concerning the combination of the lenses, and, in a manner similar to M. Clairaut and D'Alembert, points out methods of constructing achromatic telescopes.

18 Different compositions of glass for the purpose of correcting the faults of refracting telescopes.

While he was employed upon this subject, he informs us, that he received a letter from M. Zeiher, dated Petersburgh 30th of January 1764, in which he gives him a particular account of the success of his experiments on the composition of glass; and that, having mixed minium and sand in different proportions, the result of the mean refraction and the dispersion of the rays varied according to the following table.

| Proportion of minium to flint. | | | Mean refraction from air into glass. | | | Dispersion of the rays in comparison of crown glass. | | |
|---|---|---|---|---|---|---|---|---|
| I. — 3 | : | 1 | 2028 | : | 1000 | 4800 | : | 1000 |
| II. — 2 | : | 1 | 1830 | : | 1000 | 3550 | : | 1000 |
| III. — 1 | : | 1 | 1787 | : | 1000 | 3259 | : | 1000 |
| IV. — $\frac{3}{4}$ | : | 1 | 1732 | : | 1000 | 2207 | : | 1000 |
| V. — $\frac{1}{2}$ | : | 1 | 1724 | : | 1000 | 1800 | : | 1000 |
| VI. — $\frac{1}{4}$ | : | 1 | 1664 | : | 1000 | 1354 | : | 1000 |

By this table it is evident, that a greater quantity of lead not only occasions a greater dispersion of the rays, but also considerably increases the mean refraction. The first of these kinds of glass, which contains three times as much minium as flint, will appear very extraordinary; since, hitherto, no transparent substance has been known, whose refractive power exceeded the ratio of two to one, and that the dispersion occasioned by this glass is almost five times as great as that of crown glass, which could not be believed by those who entertained

Ombre

called *beasts*. And if the ombre wins all the nine tricks, it is called *winning the vole*.

Omelet.

In ombre by five, which many, on account of its not requiring so close an attention, prefer to that by three, only eight cards a-piece are dealt; and five tricks must be won, otherwise the ombre is beasted. Here the person who undertakes the game, after naming the trump, calls a king to his assistance; upon which the person in whose hand the king is, without discovering himself, is to assist him as a partner, and to share his fate. If, between both, they can make five tricks, the ombre wins two counters, and the auxiliary king only one; but when the counters are even, they divide them equally. If the ombre venture the game without calling in any king, this too is called *playing sans prendre*; in which case the other four are all against him, and he must win five tricks alone, or be beasted. The rest is much the same as by three.

Ombre *de soleil*, "Shadow of the sun," in heraldry, is when the sun is borne in armory, so as that the eyes, nose, and mouth, which at other times are represented, do not appear; and the colouring is thin, so that the field can appear through it.

OMBRIA, the ancient name of a province of Italy, in the territory of the pope, now called *Spoletto* and *Perugia*.

OMBRO, or Lombro, a town of Italy, in the duchy of Tuscany, and territory of the Siennois, situated near the Tuscan sea, a little south of the lake of Castiglione, 45 miles south-west of Sienna.

OMBROMETER, a machine to measure the quantity of rain that falls. We have the description and sign of one in Phil. Trans. N° 473. p. 12. It consists of a tin funnel, whose surface is an inch square, with a flat board, and a glass tube set into the middle of it in a groove. The rise of the water in the tube, whose capacity at different times must be measured and marked, shows the quantity of rain that has fallen.

OMELET, or Amlet, a kind of pancake or fricassee of eggs, with other ingredients, very usual in Spain and France. It may be made as follows: The eggs being beaten, are to be seasoned with salt and pepper, and then fried in butter made boiling hot; this done, gravy is to be poured on, and the whole stewed with chives and parsley shred small: when one side is fried enough, it is to be turned on the other.



Omen.

OMEN, is a word which, in its proper sense, signifies a sign or indication of some future event taken from the language of a person speaking without any intent to prophecy. Hence Tully says, "Pythagorei non solum voces deorum observarunt, sed etiam hominum, quæ vocent *omina*;" "the Pythagoreans attend to the discourse not only of gods, but also of men, which they call *omens*." This sort of omen was supposed to depend much upon the will of the person concerned in the event; whence the phrases *accepit omen, arripuit omen*. Such were the original *omens*; but they were afterwards derived from *things* as well as from words. Thus Paterculus, speaking of the head of Sulpicius on the rostrum, says it was *velut omen imminentis proscriptionis*, "the omen of an impending proscription." Suetonius says of Augustus, that he believed implicitly in certain omens; and that, *si manè sibi calceus perperam, ac sinister pro dextero induceretur, ut dirum*, "if his shoes were improperly put on in the morning, especially if the left shoe was put upon his right foot, he held it for a bad omen." Omen was used in a still larger sense, to signify an *augury*; as in the following line of Tully: "Sic aquilæ clarum firmavit Jupiter *omen*;" "thus Jove confirmed the bright omen of the eagle." It was lastly used, in the most generic sense of all, for a portent or prodigy; as in the third book of the Æneid, where a myrtle torn up by Æneas dropped blood. Upon this appearance, says the hero,

Mihi frigidus horror
Membra quatit, gelidusque coit formidine sanguis.

And the same thing being repeated upon his breaking a branch from another tree, he prayed to the gods to avert the *omen*.

Multa movens animo Nymphas venerabar agrestes,
Gradivumque patrem, Geticis qui præsidet arvis,
Rite secundarent visus, *omen*que levarent (A).

These portentous or supernatural omens were either external or internal. Of the former sort were those showers of blood so frequently occurring in the Roman history, which were much of the same nature with this adventure of Æneas, which he calls monstra deum. Of the second sort were those sudden consternations, which, seizing upon men without any visible cause, were imputed to the agency of the god *Pan*, and hence called *panic fears*. But indeed there was hardly



(A) Instead of translating these short quotations, we shall here give Dryden's version of the whole of this portentous adventure, as we are persuaded that the mere English reader, who alone can wish for a translation, will be glad to have the fullest account of the bleeding myrtle, together with its effects on the mind of the hero. It is as follows:

Not far, a rising hillock stood in view;
Sharp myrtles on the sides and corners grew.
There, while I went to crop the sylvan scenes,
And shade our altar with their leafy greens,
I pull'd a plant (with horror I relate
A prodigy so strange, and full of fate):
The rooted fibres rose; and from the wound
Black bloody drops distill'd upon the ground.
Mute and amaz'd, my hair with terror stood;
Fear shrunk my sinews, and congeal'd my blood.
Mann'd once again, another plant I try;
That other gush'd with the same sanguine dye.
Then, fearing guilt for some offence unknown,
With prayers and vows the Dryads I atone,
With all the sisters of the woods, and most
The God of arms, who rules the Thracian coast:
That they, or he, these omens would avert,
Release our fears, and better signs impart.

hardly any thing, however trivial from which the ancients did not draw omens. That it ſhould have been thought a direful omen when any thing befel the temples, altars, or ſtatues of the GODS, need excite no wonder; but that the meeting of a eunuch, a negro, a bitch with whelps, or a ſnake lying in the road, ſhould have been looked upon as portending bad fortune, is a deplorable inſtance of human weakneſs, and of the pernicious influence of ſuperſtition on the mind.

It is more than probable that this practice of making ordinary events ominous of good or bad fortune took its riſe in Egypt, the parent country of almoſt every ſuperſtition of paganiſm; but wherever it may have ariſen, it ſpread itſelf over the whole inhabited globe, and at this day prevails in a greater or leſs degree among the vulgar of all nations.

In England, is is reckoned a good omen, or a ſign of future happineſs, if the ſun ſhines on a couple coming out of the church after having been married. It is alſo eſteemed a good ſign if it rains whilſt a corpſe is burying:

> Happy is the bride that the ſun ſhines on;
> Happy is the corpſe that the rain rains on.

To break a looking glaſs is extremely unlucky; the party to whom it belongs will loſe his beſt friend.

If, going a journey on buſineſs, a ſow croſs the road, you will probably meet with a diſappointment, if not a bodily accident, before you return home. To avert this, you muſt endeavour to prevent her croſſing you; and if that cannot be done, you muſt ride round on freſh ground. If the ſow is attended with her litter of pigs, it is lucky, and denotes a ſucceſsful journey.

It is unlucky to ſee firſt one magpye, and then more; but to ſee two, denotes marriage or merriment; three, a ſucceſsful journey; four an unexpected piece of good news; five, you will ſhortly be in a great company. To kill a magpye, will certainly be puniſhed with ſome terrible misfortune.

If, in a family, the youngeſt daughter ſhould be married before her elder ſiſters, they muſt all dance at her wedding without ſhoes: this will counteract their ill luck, and procure them huſbands.

If you meet a funeral proceſſion, or one paſſes by you, always take off your hat: this keeps all evil ſpirits attending the body in good humour.

If, in eating, you miſs your mouth, and the victuals fall, it is very unlucky, and denotes approaching ſickneſs.

It is lucky to put on a ſtocking the wrong ſide outwards: changing it alters the luck.

When a perſon goes out to tranſact any important buſineſs, it is lucky to throw an old ſhoe after him.

It is unlucky to preſent a knife, ſciſſars, razor, or any ſharp or cutting inſtrument, to one's miſtreſs or friend, as they are apt to cut love and friendſhip. To avoid the ill effects of this, a pin, a farthing, or ſome trifling recompenſe, muſt be taken. To find a knife or razor, denotes ill luck and diſappointment to the party.

In the Highlands of Scotland, it is thought unlucky if a perſon ſetting out upon a journey ſtumble over the threſhold, or be obliged to return for any thing forgotten. If a ſportſman ſee any perſon ſtepping over his gun or fiſhing rod, he expects but little ſucceſs in that day's diverſion. *Sneezing* is alſo deemed ominous. If one ſneeze when making a bed, a little of the ſtraw or heath is taken out and thrown into the fire, that nothing may diſturb the reſt of the perſon who is to ſleep in the bed. Among the ſame people, ſucceſs in any enterpriſe is believed to depend greatly upon the firſt creature that preſents itſelf after the enterpriſe is undertaken. Thus, upon going to ſhoot, it is reckoned lucky to meet a horſe, but very unfortunate to ſee a hare, if ſhe eſcape; and upon meeting any creature deemed unlucky, the beſt means of averting the omen is to roll a ſtone towards it. The Greeks attributed the ſame efficacy to the rolling of a ſtone, though they greatly preferred *killing* the ominous animal, that the evil portended might fall on its own head *.

* See *Potter's Antiquities*, Vol. I. p. 346.

The motions and appearances of the clouds were not long ago conſidered as certain ſigns by which the ſkilful Highlander might attain to the knowledge of futurity. On the evening before *new year's day*, if a black cloud appeared in any part of the horizon, it was thought to prognoſticate a plague, a famine, or the death of ſome great man in that part of the country over which it ſhould appear to ſet; and in order to aſcertain the place threatened by the omen, the motions of this cloud were often watched through the whole night, if it happened to continue ſo long viſible above the horizon.

By the believers in this ſuperſtition there are days, as well as words and events, which are deemed ominous of good or bad fortune. The firſt day of every quarter, midſummer, and new year's day, are reckoned the moſt fortunate days in the year for accompliſhing any deſign. In the Iſle of Mull, ploughing, ſowing, and reaping, are always begun on *Tueſday*, though the moſt favourable weather for theſe purpoſes be in this way frequently loſt. That day of the week on which the third of May falls, is deemed unlucky throughout the whole year. In Morven, none will upon any account dig peat or turf for fuel on *Friday*; and it is reckoned unlucky to number the people or cattle belonging to any family, and doubly ſo if the number be taken on Friday. The age of the moon is alſo much attended to by the vulgar Highlanders. It it alleged, that during the increaſe things have a tendency to grow and ſtick together: and hence, in the Iſle of Sky, fences, which are there made of turf, are built only at that time; whilſt turf or peat for fuel are never, even in the moſt favourable weather, either made or ſtacked up but while the moon is in its wane. An opinion prevails in ſome places, that if a houſe take fire during the increaſe of the moon, the family to which it belongs will proſper in the world: but that if the fire happen while the moon is in the decreaſe, the family will from that time decline in its circumſtances, and ſink into poverty.

In attributing ſuch influence to the moon, the ſuperſtitious Highlanders have the honour to agree with the philoſophic Virgil, who in his Georgics gives the following ſage inſtructions to the huſbandman:

*Ipsa dies alios alio dedit ordine Luna*
*Felices, operum. Quintam fuge:*
* * * *
*Septima post decimam felix et ponere vitem,*
*Et prensos domitare boves, et licia telæ*
*Addere: nona fugæ melior, contraria furtis.*

The lucky days in each revolving moon
For labour choose: the *fifth* be sure to shun.
* * * *
The *seventh* is next the *tenth*, the best to join
Young oxen to the yoke, and plant the vine.
Then weavers stretch your stays upon the weft:
The *ninth* is good for travel, bad for theft.

DRYDEN.

From this coincidence of the superstition of the Roman poet with that of the natives of Mull and Morven, we are strongly inclined to adopt the hypothesis of the gentleman who favoured us with this accurate account of Highland omens. He justly observes, that this superstitious practice of auguring good or ill from trifling events, and from the particular phases of the moon, has no connexion whatever with popish priestcraft: he shows that the Romish clergy, even in the darkest age, were at pains to eradicate it as idle and impious; and he therefore infers, that it must be a relick of Druidism handed down by tradition from an era prior to the introduction of Christianity into the Highlands and isles of Scotland. That the Druids were acquainted with the particular doctrines of Pythagoras has been shown elsewhere (see DRUIDS); that Virgil was no stranger to the Pythagorean philosophy is known to every scholar; that Pythagoras and his followers were addicted to the dotages of MAGIC has been made apparent in that article; and therefore it appears to us probable at least, that the attention paid to pretended omens, not only in the Highlands, but also in the low country of Scotland, and indeed among the vulgar in every country of Europe, is a remnant of one of the many superstitions which the Druids imposed upon their deluded followers. That it is contrary to every principle of sound philosophy, all philosophers will readily acknowledge; and whoever has studied the writings of St Paul must be convinced that it is inconsistent with the spirit of genuine Christianity.

OMENTUM, or [illegible], the *Cawl*, in anatomy, a membranaceous part, usually furnished with a large quantity of fat; being placed under the peritonæum, and immediately above the intestines. See ANATOMY, N° 90.

OMER, in Jewish antiquity. See CORUS.

ST OMER's, a strong, fortified, large, and populous town of France, in Artois, and capital of a considerable bailiwick, with a castle and a bishop's see. It is a fortress of considerable importance, and surrounded on one side with a large morass; and about it there are many sluices, which serve to carry the water off when it is overflowed; and in the midst of the morass there is a sort of floating islands covered with verdure and trees. The cathedral is a handsome structure; and there are other fine buildings, with a rich Benedictine abbey. The French became masters of this place in 1679. It is seated on the river Aa, and on the side of a hill, eight miles north-west of Aire, and 135 north of Paris. E. Long. 2. 20. N. Lat. 54. 45.

OMOA, a Spanish town and fortification on the south side of the bay of Honduras, N. Lat. 15. 50. W. Long. 89. 50. from London. It is the key to the bay; and such is the depth of the water, that ships of any burden may ride in the harbour with safety. It is a place of the utmost importance to Spain, as the register ships to and from Guatimala are sent to it in the time of war. The town was first established in 1751, under the command of Don Joseph Antonio de Palmo. At that period the inhabitants were about 20 white men, 60 mulattoes and free negroes, and 200 slaves to the king of Spain; and the military force consisted of about 30 soldiers, besides officers. The fort was originally composed of sand confined in boarded coffers, and faced with half-burnt bricks. It was defended by 12 fine brass 24 pounders mounted, four or five iron guns of different bores, and some field-pieces. The Spaniards, sensible of the importance of the place, afterwards fortified it at an incredible expence, the stone of which the walls are built having been raised from the sea, and brought from the distance of 20 leagues. The outworks were not completely finished in the year 1779, though 1000 men had then been employed upon them for 20 years.

Towards the end of that year an expedition was undertaken against this fortress, in consequence of one formed by the Spaniards against the British logwood cutters in the bay of Honduras and on the Mosquito shore. The latter, finding themselves hard pressed by their enemies, applied to General Dulling governor of Jamaica for assistance; who accordingly sent a detachment to their relief under Captain Dalrymple, with necessary supplies of arms, ammunition, and artillery. Before their arrival, however, the Spaniards had taken possession of St George's Key, the chief settlement of the British in these parts, which they plundered, and took a number of prisoners; but those who escaped, being joined by a body of their countrymen, retook it, and forced the enemy to retire. In the mean time Captain Dalrymple, who had been informed of the loss of the place, was hastening to the relief of the inhabitants, and in his way fell in with Admiral Parker, who was in quest of some register ships; but which, retreating into the harbour of Omoa, were too strongly protected by the fort there to be attacked by sea. As the Spaniards, however, had now been compelled to abandon St George's Key, it was proposed to unite the British forces by sea and land, and to attempt the conquest of this fortress. As the force under Captain Dalrymple was too inconsiderable to attempt the fort by land, it was augmented by the marines of the squadron and a strong party of the settlers; though, after all, it did not exceed the number of the garrison who opposed them.

The troops were landed at about nine miles distance from the fort in the dusk of the evening, with a design to march directly forward, in order to surprise and carry it by escalade in the night-time. No roads, however, being found, they were obliged to explore their way through narrow foot-paths, morasses, and over mountains so beset with precipices, that they were obliged, in order to avoid them, to make use of

Omoa.

lights made of the cabbage tree In consequence of these impediments they were yet at a considerable distance from the fort, when the approach of day discovered them to the enemy. An engagement ensued, in which the Spaniards were quickly routed and driven into the town: from whence as they continued to fire upon the British, it was found necessary to set fire to it, though very much against the inclination of the assailants.

In the mean time the squadron took the opportunity, while the town was in flames, to come into the bay, and approach the fort with an intention to batter it; but the garrison returned their fire so briskly, that no impression could be made by that of the squadron, which was detained by want of wind from approaching sufficiently near. The troops then, being masters of the ground adjacent to the fort, erected several batteries in such situations as were most proper for annoying it; but though they carried on their operations with great vigour, it was still found that heavier artillery than any they possessed would be requisite, the walls being no less than 18 feet in thickness; in consequence of which they resolved still to attempt the place by escalade.

The attempt was made on the 21st of October, early in the morning. The troops entered the ditch, which fortunately for them happened to be dry, and fixed their scaling ladders against the walls, which were near 30 feet high. Two seamen mounted first; and, with admirable courage and presence of mind, stood by the ladder which they had mounted, to guard it till others ascended; and boldly presented their pieces against a large party drawn up to receive them, though they prudently retained their fire till their comrades came up.

The squadron, now drawing near, kept up a heavy and continual fire upon the fort, while the Spaniards were struck with such surprise at the excessive celerity and boldness of the assailants, that they remained motionless and unable to oppose their enemies, notwithstanding the exhortation and example of their officers. From this panic they never recovered; and while the seamen and soldiers continued to scale the walls with amazing quickness, the Spaniards never made any effort to defend themselves. About 100 of them escaped over the walls on the opposite side of the fort; the remainder surrendered at discretion.

The whole of this transaction reflected the highest lustre both on the conduct and courage of the British; and an instance of heroism is related in a British sailor to which history affords nothing superior. This man, having scaled the walls, had armed himself with a cutlass in each hand. Thus armed, he met with a Spanish officer unarmed, and just roused from sleep. The generous tar scorned to take advantage of his condition, and therefore presented him with one of his own cutlasses, saying, "You are now on a footing with me!" The officer, however, was too much struck with admiration at his conduct to accept the offer, and took care to make the circumstance sufficiently known.— The value of the booty taken on this occasion amounted to three millions of dollars; but the loss most sensibly felt by the Spaniards was that of 250 quintals of quicksilver, a commodity indispensably necessary in extracting the precious metals from their ores. They offered therefore to ransom it at any price; but though the retention of it was far from affording a profit equal to that offered by the Spaniards, the British commanders absolutely refused to part with it, on account of the advantages the enemy would derive from having the metal in their possession. For the same reason they refused to accept of any ransom for the fort, though the governor offered to lay down 300,000 dollars for it. The Spanish military and the inhabitants were treated with the utmost humanity; their personal effects remaining untouched: and this generosity must have appeared to greater advantage, when contrasted with the behaviour of their own countrymen at Honduras, where the British were treated with remarkable severity. The church plate and ornaments were restored, on condition that the terms of capitulation should be faithfully kept.

Omoa, Omophagia.

In a short time, however, it appeared that it would have been better to have accepted of a ransom for the fort, as from circumstances at that time it could not be retained in the possession of Britain. A garrison was indeed left for its defence on the departure of the British squadron; but as it was very inconsiderable, on account of the small number of men that could be spared, the Spaniards quickly determined to make an attempt to regain the fort. For this purpose a body of 2000 men were collected, who invested it on the 25th of November. The British defended it with the utmost bravery; keeping up a constant fire on the enemy, and obliging them to retire for shelter, and take up their quarters behind a hill. Here they made preparations for an assault, in which their numbers left the success, as they supposed, by no means dubious. The garrison was therefore summoned to surrender, with a promise of the honours of war and a safe conveyance to Great Britain, denouncing at the same time the utmost vengeance in case of a refusal; which being refused, the necessary preparations were made for an escalade.

The condition of the garrison was now such as could afford very little hope of being able to make any effectual resistance. They were but 85 in number, most of whom were become incapable of duty either from illness or excessive fatigue. They were now also obliged to make one centinel answer for five, by shifting his place, and challenging as many times. There was no surgeon to attend the sick and wounded; nor had they even any water out-what came from a sloop of war that lay abreast of the fort. In this desperate situation, they resolved, notwithstanding the menaces of the Spanish commander to render the place as unserviceable as they could. For this purpose they spiked up all the guns; destroying the stores and ammunition that could not be carried off: they even locked the gates of the fort, after which they embarked without the loss of a single man. All this was performed in defiance of the large force that besieged them; and the exploit, when duly considered, must appear not less a matter of astonishment than the extraordinary manner in which the fort had been taken. The officer who commanded in this remarkable retreat was Captain Hulke of the navy.

OMOPHAGIA, an ancient Greek festival, in honour of Bacchus, surnamed *Omophagos*, i. e. eater of raw flesh. This festival was observed in the same manner with the other festivals of Bacchus, in which they

counterfeited

counterfeited madness. What was peculiar to it, was, that the worshippers used to eat the entrails of goats, raw and bloody, in imitation of the god, who was supposed to do the same thing.

OMPHACINE OIL, a viscous brown juice extracted from green olives. With this oil the ancient *athletæ*, when going to wrestle, anointed themselves; and when that gymnastic exercise was over, they rolled themselves in the sand, which, mixing with the oil and sweat on their bodies, constituted the *strigmenta* so highly esteemed in the cure of several diseases. This precious medicine was carefully scraped off the body of the athleta with a kind of instrument something like a comb, which was called *strigilis*; and such was the demand for the scrapings, that they were a very lucrative article of trade.

OMPHALE (fab. hist.), a queen of Lydia, daughter of Jardanus. She married Tmolus, who at his death left her mistress of his kingdom. Omphale had been informed of the great exploits of Hercules, and wished to see so illustrious a hero. Her wish was soon gratified. After the murder of Eurytus, Hercules fell sick, and was ordered to be sold as a slave, that he might recover his health and the right use of his senses. Mercury was commissioned to sell him, and Omphale bought him, and restored him to liberty. The hero became enamoured of his mistress, and the queen favoured his passion, and had a son by him, whom some call Agelaus, and others Lamon. From this son were descended Gyges and Crœsus; but this opinion is different from the account which makes these Lydian monarchs spring from Alcæus, a son of Hercules, by one of the female servants of Omphale. Hercules is represented by the poets as so desperately enamoured of the queen, that, to conciliate her esteem, he spins by her side among her women, while she covers herself with the lion's skin, and arms herself with the club of the hero, and often strikes him with her sandals, for the uncouth manner with which he holds the distaff, &c. Their fondness was mutual. As they once travelled together, they came to a grotto on Mount Tmolus, where the queen dressed herself in the habit of her lover, and obliged him to appear in a female garment. After they had supped, they both retired to rest in different rooms, as a sacrifice on the morrow to Bacchus required. In the night Faunus, or rather Pan, who was enamoured of Omphale, introduced himself into the cave. He went to the bed of the queen, but the lion's skin persuaded him that it was the dress of Hercules; and therefore he repaired to the bed of Hercules, in hopes to find there the object of his affections. The female dress of Hercules deceived him, and he laid himself down by his side. The hero was awakened, and kicked the intruder into the middle of the cave. The noise awoke Omphale, and Faunus was discovered lying on the ground, greatly disappointed and ashamed.

OMPHALEA, in botany: A genus of the triandria order, belonging to the monœcia class of plants; and in the natural method ranking with those of which the order is doubtful. The male calyx is tetraphyllous; there is no corolla; the receptacle, into which the antheræ are sunk, is ovate. The female calyx and corolla are as in the male; the stigma trifid; the capsule carnous and trilocular, with one seed.

OMPHALO-MESENTERIC, in anatomy. All fœtuses are wrapped up in at least two coats or membranes; most of them have a third, called *allantoides*, or *urinary*.

Some, as the dog, cat, hare, &c. have a fourth, which has two blood vessels, viz. a vein and an artery, called *omphalo-mesenterics*, because passing along the string to the navel, and terminating in the mesentery.

OMRAH, a man of the first rank in the Mogul empire; a nobleman. It is the plural of the Arabic *ameer*.

ON, (anc. geog.), a city of Egypt sacred to the sun, and by the Greeks, on that account, called *Heliopolis*. (See HELIOPOLIS.) It was remarkable for the wisdom and learning of its priesthood, and for the spacious buildings in which they cultivated the studies of philosophy and astronomy. The priests of On were esteemed more noble than all the other priests of Egypt. They were always privy counsellors and ministers of state; and therefore, when Pharaoh resolved to make Joseph *prime* minister, he very wisely gave him in marriage a daughter of the priest of *On*, thereby incorporating him into the most venerable cast in Egypt. Bishop Warburton thinks that the superior nobility of the priests of *On* was chiefly owing to their high antiquity and great learning. That they were much given to the study of astronomy, we know from the testimony of Strabo; and indeed nothing is more probable than that they should be attached to the study of that system over which their god, the SUN, presided, not only in his *moral* but also in his *natural* capacity. The learned prelate affirms, that "whether they received the doctrine from original tradition, or invented it at hazard (which last supposition he thinks more probable, though we are of a very different opinion), it is certain they taught that the Sun is in the centre of its system, and that all the other bodies move round it in perpetual revolutions. This noble theory (he continues) came with the rest of the Egyptian learning into Greece (being brought thither by Pythagoras, who received it from Oenuphis*, a priest of *On*); and after having given the most distinguished lustre to his school, it sunk into obscurity, and suffered a total eclipse throughout a long succession of learned and unlearned ages; till these times restored its ancient splendour, and immoveably fixed it on the unerring principles of science."

If it be true, as some philosophers allege, that Moses appears from the first chapter of Genesis to have been acquainted with the true solar system, this account of the origin of that system is extrem[illegible] bable. As it is of no importance to the civil or religious constitution of a state whether the system of Ptolemy or that of Copernicus be admitted by the people, we cannot reasonably suppose that the Jewish lawgiver was taught astronomy by a revelation from Heaven. But there can be no doubt of his knowing as much of that science as the priests of *On*; for we know that he was instructed in all the wisdom of the Egyptians; and therefore, if he held the sun to be in the centre of the system, it is morally certain that the same thing was held by that priesthood.

ONANIA, or ONANISM, terms lately framed to denote the crime of self-pollution, mentioned in Scripture

ture to have been committed by Onan, and punished in him with death.

This practice, however common, hath among all nations been reckoned a very great crime. In Scripture, besides the instance of Onan above mentioned, we find self-polluters termed *effeminate, unclean, filthy*, and *abominable*. Even the heathens, who had not the advantage of revelation, were of the same opinion, as appears from the following lines of Martial.

*Hoc nihil esse putes! scelus est, mihi crede; sed ingens*
*Quantum vix animo concipis ipse tuo.*

You think 'tis nothing! 'tis a crime, believe!
A crime so great you scarcely can conceive.

Dr Tissot has published a treatise on the pernicious effects of this shameful practice, which appears to be no less baneful to the mind than to the body. He begins with observing, that, by the continual waste of the human body, aliments are required for our support. These aliments, however, require certain preparations in the body itself; and when by any means we become so altered that these preparations cannot be effected, the best aliments then prove insufficient for the support of the body. Of all the causes by which this morbid alteration is brought on, none is more common than too copious evacuations; and of all evacuations, that of the semen is the most pernicious when carried to excess. It is also to be observed, that though excess in natural venery is productive of very dangerous disorders, yet an equal evacuation by self-pollution, which is an unnatural way, is productive of others still more to be dreaded. The consequences enumerated by Dr Tissot are as follow:

1. All the intellectual faculties are weakened: the memory fails; the ideas are confused, and the patient sometimes even falls into a slight degree of insanity. They are continually under a kind of inward restlessness, and feel a constant anguish. They are subject to giddiness; all the senses, especially those of seeing and hearing, grow weaker and weaker, and they are subject to frightful dreams.

2. The strength entirely fails, and the growth in young persons is considerably checked. Some are afflicted with almost continual watching, and others dose almost perpetually. Almost all of them become hypochondriac or hysteric, and are afflicted with all the evils which attend these disorders. Some have been known to spit calcareous matters; and others are afflicted with coughs, slow fevers, and consumptions.

3. The patients are affected with the most acute pains in different parts of the body, as the head, breast, stomach, and intestines; while some complain of an obtuse sensation of pain all over the body on the slightest impression.

4. There are not only to be seen pimples on the face, which are one of the most common symptoms; but even blotches, or suppurative pustules, appear on the face, nose, breast, and thighs; and sometimes fleshy excrescences arise on the forehead.

5. The organs of generation are also affected; and the semen is evacuted on the slightest irritation, even that of going to stool. Numbers are afflicted with an habitual gonorrhœa, which entirely destroys the vigour of the constitution, and the matter of it resembles a fetid sanies. Others are affected with painful priapisms, dysuries, stranguries, and heat of urine, with painful tumours in the testicles, penis, bladder, and spermatic cord; and impotence in a greater or less degree is the never-failing consequence of this detestable vice.

6. The functions of the intestines are sometimes totally destroyed; and some patients complain of costiveness, others of diarrhœa, piles, and the running of a fetid matter from the fundament.

With regard to the cure, the first step is to leave off those practices which have occasioned the disease; which our author asserts is no easy matter; as, according to him, the soul itself becomes polluted, and can dwell on no other idea; or if she does, the irritability of the parts of generation themselves quickly recal ideas of the same kind. This irritability is no doubt much more to be dreaded than any pollution the soul can have received; and by removing it, there will be no occasion for exhortations to discontinue the practice. The principal means for diminishing this irritability are, in the first place, to avoid all stimulating, acrid, and spiced meats. A low diet, however, is improper, because it would further reduce the body, already too much emaciated. The food should therefore be nutritive, but plain, and should consist of flesh rather roasted than boiled, rich broths, &c. It is certain, however, that as these foods contribute to restore the strength of the body, the stimulus on the organs of generation will be proportionably increased by the semen which is constantly secreted, and which will now be in larger quantity than even in healthy persons, owing to the great evacuations of it which have preceded. Some part of the semen is gradually absorbed by the lymphatics; in consequence of which, the remainder becomes thick, acrid, and very stimulating. To remedy this, exercise is to be used, and that not only for pleasure, but till it is attended with a very considerable degree of fatigue. The sleep also must be no more than is barely sufficient to repair the fatigue occasioned by the exercise, or other employment; for an excess in sleep is as bad as idleness or stimulating foods. Excess in wine or intoxicating liquors is also to be avoided; or rather such liquors ought never to be tasted, unless as a medicine to restore the exhausted spirits; and to all this ought to be joined the Peruvian bark, which hath this admirable property, that, with little or no stimulus, it restores the tone of the system, and invigorates the body in a manner incredible to those who have not observed its effects. If these directions are followed, the patient may almost certainly expect a recovery, provided any degree of vital strength remains; and those who desire a life of celibacy on a moral account, will find them much more effectual than all the vows of chastity they can make.

ONCA and ONCE. See FELIS, IV. and VI.

ONEEHOURA and ONEEHOW, two small islands of that cluster which was discovered by Captain Cook, and by him called the *Sandwich Islands*. (See SANDWICH ISLANDS). *Oneehoura* is very small, and its chief produce is yams. *Oneehow* is considerably larger, being about ten miles over. It is remarkable for the great quantity of excellent yams, which it produces, and for a sweet root called *tee* or *tea*, which is general-

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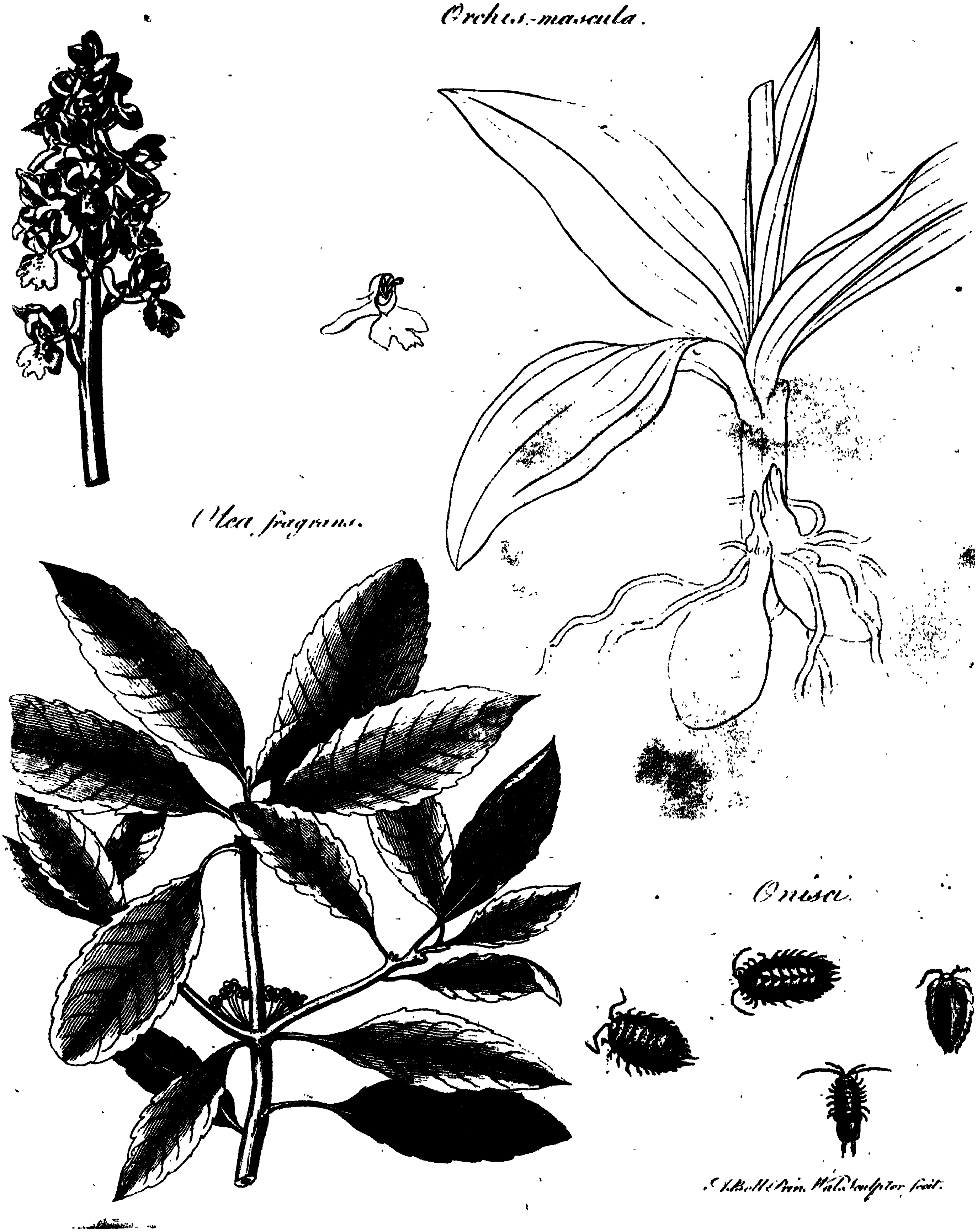
Plate CCCXLIX.



ly about the thickneſs of a man's wriſt, though ſometimes much larger. This root, which the natives commonly bake previous to their bringing it to market, is of a wet clammy nature, and with proper management makes excellent beer.

ONEGA, a river and lake of the Ruſſian empire, between Muſcovite Carelia, the territory of Cargapol, and Swediſh Carelia. It is 100 miles in length and 40 in breadth, having a communication with the lake Ladoga, and conſequently with Peterſburgh. The river has its ſource in Cargapol, and gives its name to a country full of woods.

ONEGLIA, a ſea port town of Italy, in the territory of Genoa, with the title of a principality; but it belongs to the king of Sardinia, as well as the province, which abounds in olive trees, fruit, and wine. It has often been taken and retaken in the wars of Italy; which is no wonder, as it is an open place. The French and Spaniards had poſſeſſion of it in 1744, but were driven out by the Piedmonteſe; however, they returned next winter, and again made themſelves maſters of it. E. Long. 7. 51. N. Lat. 43. 58.

ONEIROCRITICA, the art of interpreting dreams; or a method of foretelling future events by means of dreams. See DREAM, DIVINATION, &c.—The word is formed from the Greek ονειρος, "dream," and κριτικα, of κρισις, "judgment."—Some call it *oneirocratica*; and derive it from ονειρος and κρατεω, "I poſſeſs, I command."

It appears from ſeveral paſſages of Scripture, that there was, under the Jewiſh diſpenſation, ſuch a thing as foretelling future events by dreams; but then there was a particular gift or revelation required for that purpoſe.

Hence it has been inferred, that dreams are really ſignificative, and do forbode ſomething to come; and all that is wanting among us is the *oneirocritica*, or the art of knowing what: yet it is the opinion of many, that dreams are mere chimeras; bearing indeed ſome relation to what has paſſed, but none to what is to come. As to the caſe of Joſeph, it was poſſible for God, who knew all things, to diſcover to him what was in the womb of fate; and to introduce that, he might take the occaſion of a dream.

ONEIROCRITICS, a title given to interpreters of dreams, or thoſe who judge of events from the circumſtances of dreams.

There is no great regard to be had to thoſe Greek books called *oneirocritics*; nor do we know why the patriarch of Conſtantinople, and others, ſhould amuſe themſelves with writing on ſo pitiful a ſubject.

Rigault has given us a collection of the Greek and Latin works of this kind; one attributed to Aſtrampſichus; another to Nicephorus, patriarch of Conſtantinople; to which are added the treatiſes of Artemidorus and Achmet. But the books themſelves are little elſe than reveries; a kind of waking dreams, to explain and account for ſleeping ones.

The ſecret of oneirocriticiſm, according to them all, conſiſts in the relation ſuppoſed to be between the dream and the thing ſignified: but they are far from keeping to the relations of agreement and ſimilitude; and frequently have recourſe to others of diſſimilitude and contrariety. Concerning oneirocritics and oneirocritica, the unlearned reader will find much information in Warburton's Divine Legation of Moſes, and the books to which he refers.



ONESIÆ THERMÆ, were, according to Strabo, *excellent baths*, and *ſalutary waters*, at the foot of the Pyrenees in Aquitania. Near the river Aturus ſtands at this day the town Bagneres, famous for its waters, which appear to be the *Oneſiæ* of Strabo; ſituated in the county of Bigorre in Gaſcony, near the river Adour.

ONIÆ OPPIDUM and *Templum*, (Joſephus); ſo called from Onias, the high-prieſt of the Jews in Egypt; who built a temple in imitation of that at Jeruſalem, by permiſſion of the king of Egypt, on the ſpot where ſtood the temple of Diana Agreſtis in Leontopolis: it was encompaſſed with a brick wall, and had a large tower like that at Jeruſalem, (Joſephus): it was the metropolis of the Nomos Heliopolites, (Ptolemy); becauſe in Strabo's time Heliopolis was fallen to decay.

ONGLEE, in heraldry, an appellation given to the talons or claws of beaſts or birds, when borne of a different colour from that of the body of the animal.

ONION. See ALLIUM, ſp. 5.—Onions, leeks, and garlic, are all of the ſame genus; and in their recent ſtate are acrid, but harmleſs to the human body. When, by age or climate, this acrimony is too great, we do not uſe them as food. In Spain, the garlic being equally mild with the onion, is uſed as common food. By the ordinary culinary preparation their acrimony is diſſipated, and a remarkably mild ſubſtance remains, promiſing much nutriment, which thoſe who can digeſt them raw will certainly obtain. Though ſometimes ſhunned as food, yet they are on that account uſed in medicine, uniting the two qualities of pectorals, viz. on the account of their acrimony, being in their recent ſtate expectorant; in their boiled ſtate, on account of their mucilage, demulcent, provided the quantity taken be ſufficient. Some of late, in this country, have found in leeks a ſomniferous quality; but this is not yet confirmed by a ſufficient number of experiments.—Beſides the three above-mentioned, there are ſeveral others belonging to the ſame tribe, which we uſe as condiment; but only the leek and onion as diet. In its recent ſtate, the onion is the moſt acrid; in its boiled ſtate, the leek retains its acrimony moſt tenaciouſly. On account of this, and ſome difference of texture, the onion is more eaſily digeſted and more univerſally uſed than the leek; being more eaſily broke down, and more generally agreeable.

ONISCUS, in zoology, a genus of inſects belonging to the order of aptera. It has 14 legs, briſtly feelers, and an oval body. There are 15 ſpecies; of which the moſt remarkable are, Pla CCCXLIX.

1. The *entomon*, or *ſea wood-louſe*, is white; eyes black; convex above, beneath flat, margin acute; antennæ 4: Four hind pair of legs largeſt, hairy. Body of 10 ſegments. Length 1½ line. Found on the coaſt. It accompanies the herring, and is an enemy well known to our fiſhermen; theſe inſects will frequently eat up a whole fiſh while it hangs in the net.

2. *Oniſcus aquaticus*, is of an aſhen colour, and tolerably ſmooth. Its body is compoſed of ſeven articulations, excluſive of the head and tail; which laſt part is

is much larger than the other segments, round at the extremity, and from which issue two appendices, each divided into two threads. This insect has that in common with some sea onisci, but differs from them by the sea ones having ten segments. This has seven legs on each side; the last of which gradually increase in length, and are constantly larger than the foremost.—The antennæ have but three long articulations, the last of which is much longer than the rest. This insect is found in pools, small rivulets, and especially in springs.

3. *Asellus, millepes*, or *wood-louse*, is oval; the tail obtuse, with two undivided bristles: various as to colour: length, five lines. Their use in medicine is well known.

4. *Oniscus armadillo* is broad, very glossy, and smooth: its colour is black, with a small portion of white on the edge of the segment, which colour often varies; but still the insect is glossy and smooth. Its body is composed of ten segments, besides the head and tail.—Of the ten segments, the first seven are broad, and the last three short. The first of these three appears divided in the middle, which is broader than the rest, into three more. These last short segments, with that of the tail, form the extremity of the animal's body, which is round, without any appendix, and constitutes the specific character of this insect. It has fourteen feet, seven on each side. This oniscus, when touched, rolls itself up into a ball, bringing its head and tail together like the animal called *armadillo*, and neither antennæ nor feet are seen: it might be taken for a round, shining pearl. This oniscus is found in woods.

ONKELOS, surnamed the *Proselyte*, a famous rabbi of the first century, and the author of the Chaldee Targum on the Pentateuch. He flourished in the time of Jesus Christ, according to the Jewish writers; who all agree that he was, at least in some part of his life, contemporary with Jonathan Ben Uzziel, author of the second Targum upon the prophets. Dean Prideaux thinks he was the elder of the two, for several reasons: the chief of which is the purity of the style in his Targum, therein coming nearest to that part of Daniel and Ezra which is in the Chaldee, and is the truest standard of that language, and consequently is the most ancient; since that language, as well as others, was in a constant flux, and continued deviating in every age from the original: nor does there seem to be any reason why Jonathan Ben Uzziel, when he undertook his Targum, should pass over the law, and begin with the prophets, but that he found Onkelos had done this work before him, and with a success which he could not exceed.

Azarias, the author of a book entitled *Meor Enaim*, or the *light of the eyes*, tells us, that Onkelos was a proselyte in the time of Hillel and Samnai, and lived to see Jonathan Ben Uzziel one of the prime scholars of Hillel. These three doctors flourished 12 years before Christ, according to the chronology of Gauz; who adds, that Onkelos was contemporary with Gamaliel the elder, St Paul's master, who was the grandson of Hillel, who lived 28 years after Christ, and did not die till 18 years before the destruction of Jerusalem. He the same Gauz, by his calculation, places Onkelos 100 years after Christ; and to adjust his opinion with that of Azarias, extends the life of Onkelos to a great length. The Talmudists tell us that he assisted at the funeral of Gamaliel, and was at a prodigious expence to make it most magnificent. Dean Prideaux observes, that the Targum of Onkelos is rather a version than a paraphrase; since it renders the Hebrew text word for word, and for the most part accurately and exactly, and is by much the best of all this sort: and therefore it has always been held in esteem among the Jews much above all the other Targums: and being set to the same musical notes with the Hebrew text, is thereby made capable of being read in the same tone with it in their public assemblies.—From the excellency and accuracy of Onkelos's Targum, the dean also concludes him to have been a native Jew, since without being bred up from his birth in the Jewish religion and learning, and long exercised in all the rites and doctrines thereof, and being also thoroughly skilled in both the Hebrew and Chaldee languages, as far as a native Jew could be, he can scarce be thought thoroughly adequate to that work which he performed; and that the representing him as a proselyte seems to have proceeded from the error of taking him to have been the same with Akilas, or Aquila, of Pontus, author of the Greek Targum or version of the prophets and Hagiographia, who was indeed a Jewish proselyte.



ONKOTOMY, in surgery, the opening of a tumour or abscess. See SURGERY.

ONOCLEA, in botany: A genus of the natural order of filices, belonging to the cryptogamia class of plants. The spike is flat, and turned to each side, with quinquevalved fructifications.

ONOMANCIA, or rather ONOMANTIA, a branch of divination, which foretels the good or bad fortune of a man, from the letters in his name. See the article DIVINATION, and NAME.

From much the same principle the young Romans toasted their mistresses as often as there were letters in their names: Hence Martial says,

*Nævia sex cyathis, septem Justina bibatur.*

ONOMATOPOEIA, in grammar and rhetoric, a figure where words are formed to resemble the sound made by the thing signified; as the buzz of bees, the cackling of hens, &c. Resemblances of this kind are often fancied when they are not real, though, no doubt, there are in every language some words of which the sound is very like to that which those words are employed to express. Yet, to the mortification of grammarians and rhetoricians, conjunctions, which have been justly pronounced no parts of speech, are the only sounds uttered by men that are wholly natural, and these are fewer than is commonly supposed. See GRAMMAR and LANGUAGE.

ONONIS, in botany: A genus of the decandria order, belonging to the diadelphia class of plants. The calyx is quinquepartite, with the segments linear; the vexillum striated; the legumen turgid and sessile; the filaments coalited without a fissure.

ONOPORDUM, in botany: A genus of the polygamia æqualis order, belonging to the syngenesia class of plants; and in the natural method ranking under the

the 49th order, *Compositæ*. The receptacle is honeycombed; the scales of the calyx mucronated or pointed.

ONOSANDER, a Greek author and Platonic philosopher, who wrote Commentaries on Plato's Politics, which are lost: but his name is particularly famous for a treatise entitled Λογος Στρατηγικος, "Of the duty and virtues of the general of an army;" which has been translated into Latin, Italian, Spanish, and French. The time when he lived is not precisely known: but is imagined to be in the reign of the emperor Claudius.

ONOSMA, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural method ranking under the 41st order, *Asperifoliæ*. The corolla is campanulated, with the throat pervious: there are four seeds.

ONTARIO, a lake of North America, in the country of the Iroquois, 180 miles in length and 60 in breadth. There are many rivers that run into it; and from it the great river St Lawrence proceeds. It communicates with the lake Erie by a river 33 miles in length, in which is the remarkable cataract of NIAGARA.

ONTOLOGY. See METAPHYSICS, N° 3.

ONUPHRIUS PANVINUS, a learned Italian, of the order of hermits of St Augustine, was born of a noble family at Verona, in 1529; and, being trained to literature, became so indefatigable in his studies, that he spent whole days and nights in reading the ancients: which made Manutius style him *Helluo Antiquitatis*. His first performance was a Chronicle of Popes and Cardinals, which was printed without his knowledge at Venice in 1557; and some time after, more correctly by himself. He afterwards continued Platina's Lives of the Popes, from Sixtus IV. to Pius V. and subjoined annotations to the lives Platina had written. He also wrote four pieces upon Roman Antiquities, which are printed in Grævius's Collection. He died in his 39th year, in 1568.

ONYCOMANCY, or, as some write it, ONYMANCY; a kind of divination by means of the nails of the fingers.——The word is formed from the Greek ονυξ, "nail," and μαντεια, "divination."

The ancient practice was to rub the nails of a youth with oil and soot, or wax; and to hold up the nails thus smeared against the sun.—Upon them were supposed to appear figures or characters, which showed the thing required.

ONYX, in natural history, one of the semipellucid gems, with variously coloured zones, but none red: being composed of crystal, debased by a small admixture of earth; and made up either of a number of flat plates, or of a series of coats surrounding a central nucleus, and separated from each other by veins of a different colour, resembling zones or belts.

We have four species of this gem. 1. A bluish white one, with broad white zones. 2. A very pure onyx, with snow-white veins. 3. The jasponyx, or horny onyx, with green zones. 4. The brown onyx, with bluish white zones.

The ancients attributed wonderful properties to the onyx, and imagined that if worn on the finger it acted as a cardiac; they have also recommended it as an astringent; but at present no regard is paid to it.

The word in the Greek language signifies *nail*; the poets making this stone to have been formed by the Parcæ from a piece of Venus's nails, cut off by Cupid with one of his arrows.

OONALASHKA, one of the islands of the Northern Archipelago, visited by Captain Cook in his last voyage. The native inhabitants of this island are, to all appearances, a very peaceable people, having been much polished by the Russians, who now keep them in a state of subjection. As the island furnishes them with subsistence, so it does, in some measure, with clothing, which is chiefly composed of skins. The upper garment, which is made like a waggoner's frock, reaches down to the knees. Besides this, they wear a waistcoat or two, a pair of breeches, a fur cap, and a pair of boots, the legs of which are formed of some kind of strong gut; but the soles and upper-leathers are of Russia leather. Fish and other sea animals, birds, roots, berries, and even sea weed, compose their food. They dry quantities of fish during the summer, which they lay up in small huts for their use in winter. They did not appear to be very desirous of iron, nor to want any other instrument, except sewing needles, their own being formed of bone. With these they sew their canoes, and make their clothes, and also work their curious embroidery. They use, instead of thread, the fibres of plants, which they split to the thickness required. All sewing is performed by the females, who are shoemakers, tailors, and boat-builders. They manufacture mats and baskets of grass, which are both strong and beautiful. There is indeed a neatness and perfection in most of their works, that shows they are deficient neither in ingenuity nor perseverance.

Though the climate is sometimes severe, Captain Cook did not observe a fire-place in any of their habitations. They are lighted as well as heated by lamps; which, though simple, effectually answer the purpose for which they are intended. They consist of a flat stone, hollowed on one side like a plate; in the hollow part they put the oil, mixed with some dry grass, which serves for a wick. Both sexes often warm themselves over one of these lamps, by placing it between their legs, under their garments, and sitting thus over it for several minutes. E. Long. 139. 29. N. Lat. 53. 5.

OONELLA, OONEMAH, two islands of the same Archipelago with Oonalashka; the former of which lies to the north-east of that island, being separated from it by a navigable strait; the other is more to the westward, being in E. Long. 192. 30. and N. Lat. 54. 30. The circumference of Oonella is about seven leagues, and the produce of both much the same with that of Oonalashka.

OORT (Adam Van), born at Antwerp in 1557, was the son of Lambert Van Oort, a painter of considerable reputation for perspective and architecture. Adam was instructed in the art by his father, and afforded sufficient proofs of his having an enlarged genius; so that he soon rose into esteem, not only as a painter of history, but as an able artist in landscape and portrait. But the greatest honour of Van Oort proceeded from his having been the first instructor of Rubens, whose works have eternized his master's memory, along with his own.

Ooſt.

Naturally he was of a rough and diſagreeable temper, which occaſioned him to loſe the love of his diſciples and his friends; and among the number, he totally forfeited the eſteem of Rubens, his beſt pupil. Jordaens was the only perſon who accommodated himſelf to the ſavage humour of his maſter; but it appears probable, that he only condeſcended to endure his moroſe behaviour, out of affection to the daughter of Van Oort, to whom Jordaens was afterwards married.

In his ſtyle of painting, however, he neglected nature, and was entirely a manneriſt; nor did he ſeem to have any regard to painting as a fine art, but merely as an art that might be the means of making him rich. In his beſt time, his compoſition was agreeable and his deſign correct; but in his latter time, his works had nothing to recommend them, except the freedom of handling, and the goodneſs of their colouring; yet, with all his defects, he was accounted a good painter. Rubens uſed to ſay, that Van Oort would have ſurpaſſed all his contemporaries, if he had ſeen Rome, and formed his taſte by ſtudying after the beſt models. He painted a great number of deſigns for the altars of churches in Flanders, which have much merit in ſeveral parts; and they are ſtill beheld with pleaſure by good judges.

OOST, a kiln for drying hops after they are picked from the ſtalks.

Oost (Jaques Van), a painter of hiſtory, landſcape, and architecture, was born at Bruges about the year 1600, and learned the art in his native city, though it is not aſcertained by what maſter he was inſtructed; but he travelled to Italy to ſtudy after the works of the great maſters, and copied every thing that pleaſed his own taſte, or that he thought might contribute to his improvement. However, among all the famous artiſts, he attached himſelf particularly to the ſtyle of Annibal Caracci, and imitated him in ſuch a manner, as to ſurpriſe the moſt able connoiſſeurs at Rome.

He poſſeſſed many of the accompliſhments of a great painter. His touch and his colouring were good; he introduced but few figures in his deſigns, to avoid encumbering his ſubject; and he diſpoſed them with a great deal of ſkill and elegance; giving them ſuch draperies as were ſimple and natural. He deſigned in a good taſte; and though his ſtyle of compoſition reſembled that of Annibal, yet it was leſs charged than the deſigns of that maſter uſually are. In his carnations, his colouring was freſh and like nature; but he is not ſo commendable in the colour of his draperies, which is ſometimes ſo broken as to give the ſtuffs an appearance of hardneſs. He underſtood perſpective and architecture extremely well; and as he was not fond of painting landſcape (though occaſionally he painted it well), in the ſtead of it he ornamented his back grounds moſt frequently with buildings, columns, arches, and different pieces of architecture, which gave his compoſition a grand effect.

The moſt admired picture of Van Ooſt is in the church at Bruges which belonged to the Jeſuits: the ſubject of it is, a Deſcent from the Croſs; in which the deſign, the diſpoſition, the expreſſion, colour, and chiaro-ſcuro, are worthy of the higheſt praiſes. He had a ſon of the ſame name, who acquired conſiderable fame in his profeſſion.

Opacity, Opah.

OPACITY, in philoſophy, a quality of bodies which renders them impervious to the rays of light.

OPAH, commonly called the *king fiſh*. See Zeus. The body is deep; the ſcales exceedingly minute: it has ſetaceous teeth on the tongue only, one long dorſal fin, and a tail ſomewhat lunated. The genus of which this is a ſpecies is not numerous: This, however, is conſiderably the largeſt, and with reſpect to its colours the moſt ſplendid. It is conſidered by many as the moſt beautiful fiſh that is found on the coaſt of Europe. Mr Pennant in his Britiſh Zoology gives the following account of this fiſh, which is exceedingly rare on the Britiſh coaſt: "We have only four inſtances (ſays he) of this fiſh being taken in our ſeas, each of them in the north, viz. twice off Scotland, once off Northumberland, and once in Filey Bay, Yorkſhire. This laſt was caught about two years ago, and exhibited as a ſhow at Scarborough. Plate CCCLI.

"It is of that genus which Linnæus diſtinguiſhes by the name of *Chætodon* from its briſtly teeth, and is ſaid to be very common on the coaſt of Guinea. See Chætodon. (A)

"It is well deſcribed by an anonymous writer in the London Magazine for October 1767, which we ſhall borrow, as the account is confirmed to us by Mr T who had an opportunity of examining one of the ſpecies.

"Newcaſtle, September 12. On Saturday was thrown upon the ſands at Blyth, a very rare and beautiful fiſh, weighing between 70 and 80 pounds, ſhaped like the ſea bream. The length was three feet and a half; the breadth from back to belly almoſt two feet; but the thickneſs from ſide to ſide not above ſix inches.

"The mouth ſmall for the ſize of the fiſh, forming a ſquare opening, and without any teeth in the jaws. The tongue thick, reſembling that of a man but rough and thick ſet with beards or prickles, pointing backwards, ſo that any thing might eaſily paſs down, but could not eaſily return back; therefore theſe might ſerve inſtead of teeth to retain its prey. The eyes remarkably large, covered with a membrane, and ſhining with a glare of gold. The cover of the gills like the ſalmon.

"The body diminiſhes very ſmall to the tail, which is forked, and expands 12 inches: the gill fins are broad, about eight inches long, and play horizontally: a little behind their inſertion the back fin takes its original, where it is about ſeven inches high, but ſlopes away very ſuddenly, running down very near the tail, and, at its termination becomes a little broader: the belly fins are very ſtrong, and placed near the middle of the body: a narrow fin alſo runs from the anus to the tail.

"All

(A) Later writers ſeem with more propriety to have ranked it under the genus *Zeus*, to which we have already referred.

Opal.

"All the fins, and alſo the tail, are of a fine ſcarlet; but the colours and beauty of the reſt of the body, which is ſmooth and covered with almoſt imperceptible ſcales, beggars all deſcription; the upper part being a kind of bright green, variegated with whitiſh ſpots, and enriched with a ſhining golden hue, much reſembling the ſplendour of the peacock's feathers; this by degrees vaniſhes in a bright ſilver: and near the belly the gold begins again to predominate in a lighter ground than on the back."

OPAL, in natural hiſtory, a ſpecies of the chroaſtaces genus of gems.—This ſpecies of precious ſtone is generally eſteemed the moſt beautiful of all the flinty tribe, which appears to be owing to its changeable appearance when viewed by reflection.—The form of the opal is that of a pebble, like the agate, with which authors in general have claſſed it, from a ſuppoſed reſemblance of which there appears no ſort of proof. On the contrary, Bergman's analyſis points it out to be of a very different nature from the genus of flints, of which the agate is a ſpecies; magneſia conſtituting a large part of its compoſition, and not entering at all into that of the agate, if we are to judge from the analyſis of the parent ſpecies or flint, there being none yet publiſhed of agate. The ſpecific gravity of the opal is likewiſe extremely different from that of the agate. Wallerius tells us that its ſpecific gravity is upwards of 1900. It loſes its colour and tranſparency in the fire, and in other reſpects is affected by it in the very ſame manner as quartz or flint would be. It may be melted with borax, but not without great difficulty. The ſpecies are,

1. The opal of Nonnius. This appears olive-coloured by reflection, and then opaque; but when held between the eye and the light, it is found to be tranſparent, and appears of a beautiful ruby colour. Boecede Boot, author of the *Complete Jeweller*, conſiders it as the moſt precious ſort of opal, and indeed the moſt wonderful of this kind of nature's works: he gives a lofty encomium upon it, chiefly from Pliny, who called this opal *pæderos*. This ſpecies of opal is the *ſangenon* of India, and *nonnius* of the ancients and modern Europeans, from the Roman ſenator Nonnius poſſeſſor of the famous opal of Rome, worth 20,000 ſeſterces, who preferred baniſhment to parting with it to Antony. An opal anſwering exactly to Pliny's deſcription of the nonnius was diſcovered about 30 or 35 years ago in the ruins of Alexandria, and purchaſed for a trifle by the French conſul Lironcourt, from his dragoman Roboly. The duke de Nivernois, when ambaſſador in London in 1763, was in poſſeſſion of the very ſtone. The next in eſteem and value is the Iris opal, of a glaſſy white colour, but when looked through it appears of a flame colour, as the nonnius does of a ruby.

Wallerius indeed is of opinion that the opal found in Alexandria was not that of Nonnius mentioned by Pliny; and adds, that it was by many ſuppoſed to be only a counterfeit piece of glaſs or paſte. There is another of the ſame ſpecies in Sweden, which by reflection appears of a browniſh colour, but by refraction is red with violet veins.

2. The white opal, having its ground of a white glaſs-like complexion, from whence green, yellow, bluiſh, and purple rays are thrown out; but when held againſt the light it appears of a reddiſh or rather flame colour. Wallerius, in his Mineralogy, ſays, that this white opal anſwers the deſcription of it given by Pliny much better than the olive-coloured one above deſcribed. There are two varieties of it: 1. The oriental opal, ſhowing many colours.—Engenſtroom informs us, that he had obtained a ſmall piece of pſeudo-agate from the Eaſt Indies, of a yellowiſh brown and pale blue, or rather milk colour, with a ſhining brightneſs exactly like that of the milky opals already mentioned; alſo ſome other ſpecimens near Turin in Piedmont, where they are called *baſtard agates*, a name which, in his opinion, is extremely proper for them, as they agree with the agates in almoſt every reſpect except hardneſs: this, however, has been controverted.—Sometimes the opal is ſurrounded with a white cruſt, like common flints in the ſtrata of chalk: which cruſt has likewiſe the ſame properties as the flint when this laſt mentioned ſubſtance has been previouſly freed from the adherent chalk; viz. 1. It does not diſſolve in nitrous acid. 2. It is not fuſible *per ſe*. 3. It melts pretty eaſily with borax, but without any efferveſcence, contrary to what is obſerved in calcareous ſubſtances; ſo that borax will diſſolve about three quarters of its own bulk of this ſubſtance, though with difficulty, eſpecially towards the end of the operation; but the glaſs becomes quite clear and colourleſs, inſtead of becoming white and opaque, as is the caſe with calcareous ſubſtances. This oriental ſtone is found in the iſland of Ceylon, where it is called the *elementary ſtone*. The Indians put as high a value on it as on the diamond. There is another kind of oriental opal much valued, generally called the *flaming opal*, becauſe it changes its colours, as if ſparks of fire eſcaped from it in parallel lines.

3. The bluiſh and ſemitranſparent opal is leſs valued by thoſe who are converſant in gems than the others, on account of its being ſuppoſed more eaſily imitable by art. M. Magellan, however, informs us, that not only this, but ſeveral other kinds of opals are eaſily imitable by art; ſeveral compoſitions of glaſs being met with which ſhow very different colours by reflection and by refraction. A curious ancient one of this kind is to be ſeen in the royal abbey of St Denis near Paris, which is green on the outſide, but ſhows a fine ruby colour when held between the eye and the light. Our author has alſo ſeen ſome glaſs paſtes made in London by Edward Delaval, Eſq; and others by Mr More ſecretary to the Society of Arts, which appeared of a yellow brown or other colour by reflection; but when held againſt the light tranſmitted a fine blue, purple, or red colour, like the ſapphires, rubies, garnets, and other precious ſtones. Wallerius gives directions for making theſe paſtes; and M. Magellan informs us, that he by chance diſcovered that the red glaſs of Kunckel, when over-melted or burnt in a common fire, produces a ſimilar effect, tranſmitting one colour by refraction and another by reflection. The fine imitations of the true white opals, which Pliny ſays were made by the Indians, have, in our author's opinion, hitherto baffled the art of the moderns.

 The

The sangenon or nonnius opal is found in the East Indies; the Iris, in Ceylon; the milky opal, at Eilbenstock and Fryberg; the blush or most common and least esteemed, in Hungary, Silesia, Saxony, &c.; the olive and bottle-coloured cat's eye, in Ceylon; the inferior in different countries of Europe. Mr Born mentions what he calls an *avanturine cat's eye*, of a flesh colour and transparent, possessing the curious structure of the avanturine, viz. composed of little plates like scales, with a metallic splendour, which reflects the rays of light like the opal. This stone we suspect to be that which has led authors to class the avanturine with the opal, although it is in fact a fine opaque quartz. Russia produces the opal at the rivulet Katscha, near the city of Krasnajark, in the Altai mountains in Siberia. The cat's eye is found in Mount Caucasus, and is often confounded with the opal, though improperly. See Asteria. The oculus mundi (see Hydrophanes) has a very intimate connexion with opal, being generally found in beds over it, and being regarded by some naturalists as the same stone in a state of decomposition by the action of the air. Russia possesses this stone in the Altai mountains, where the opals are found.

No method of estimating the opal is given by authors that we know of. But those of uncommon beauty and size are sold for very large sums.

The late Leopold II. emperor of Germany, was in possession of an oriental stone, sometimes described as a cat's eye and sometimes as an opal, of one inch diameter, and which was valued at a great price. Prince Potemkin, the Russian general, purchased for 1000 ducats a stone of the same kind, said to have been taken by the famous Nadir Shah from the head of a Gentoo idol, of which it made one of the eyes. By what circuitous road it found its way to Potemkin, we have not been informed; but with many other gems it disappeared from the tent of the Persian conqueror when he was assassinated.

Opals are commonly found in detached pieces, in an envelope of a different kind of stone, from the size of a pin head to that of a walnut. Beautiful opals of this last size are extremely rare; so that it is difficult to find an opal sufficiently perfect and large to be completely possessed of all its beauties: this renders it so precious, and makes it almost impossible to determine its value. They have agreed, however, to value a beautiful oriental opal at double the price of a sapphire of the same size.

It is very remarkable, that all the beautiful colours of the opal may entirely change or disappear when the stone is divided into pieces. This phenomenon, which has been demonstrated more than once by experience, leads us to think that all the sparkling play of the opal is owing to the refraction of the rays of the sun from the surface of the stone, which is naturally formed to produce this refraction.

OPALIA, in antiquity, feasts celebrated at Rome in honour of the goddess Ops. Varro says they were held on the 19th of December, which was one of the days of the Saturnalia: these two feasts were celebrated in the same month, because Saturn and Ops were husband and wife: the vows offered to the goddess were made sitting on the ground.



OPERA, a dramatic composition set to music, and sung on the stage, accompanied with musical instruments, and enriched with magnificent dresses, machines, and other decorations.—This species of drama is of modern invention. In its present state it was not known even in Italy before the beginning of the last century; and at its introduction into England, a century afterwards, it divided the wits, literati, and musicians of the age. By those who were esteemed the best judges of the art, the English language was considered as too rough and inharmonious for the music of the opera; and, on the other hand, critics, whose taste was built on the basis of common sense, looked upon a drama in a foreign and unknown tongue as the greatest of all absurdities. Many of them, however, pleaded for operas in the English language; and it is well known that Addison, who was one of the opposers of the Italian opera on the London stage, wrote in his native tongue the opera of Rosamond. This is confessedly a beautiful poem; but, in the opinion of Dr Burney, it adds nothing to Addison's fame, as it shows his total ignorance of the first principles of music, and of course his unfitness for the task he had undertaken.

In questions respecting the fine arts there is no appeal from the general taste; and therefore, as the French opera, which is in the language of the country where it is acted, has always been admired by persons of liberal education, it doubtless has merit considered as a drama; but how the dramas of this kind which are composed in Italian should find admirers in England, among persons who understood not a word of the language, is to us a matter of astonishment. The music of them may deserve and command the admiration of every one who has an ear; and th action of the fingers may be perfectly suitable to the subject represented; but of this suitableness the majority of the audience can be no judges.

Even when the language is thoroughly understood, we should imagine, that, to make an opera agreeable to good sense, much would depend upon the choice of the subject; for it is surely absurd to have persons of all ranks, and on every occasion, perpetually accompanied with the regular responses of symphony. To hear Cæsar, Scipio, or Macbeth, when forming plans to ensure [illegible], or hatching plots of treason and murder, talk[illegible] recitative and keeping time with fiddles, wo[illegible]ly disgust every person whose sense had not all evaporated in sound; but when the subject represented naturally admits of music in real life, we can suppose an opera to afford to persons of taste one of the most exquisite and refined entertainments of which human nature is capable. For a further account of the opera, see Music, N° 39, 42, 44, and Poetry, N° [illegible], &c.

OPERATIO[illegible] in general, the act of exerting or exercising some power or faculty, upon which an effect follows.

Operation, in surgery and medicine, denotes a methodical action of the hand on the human body, in order to re-establish health.

OPHIDIUM, a genus of fishes belonging to the order of apodes. The principal characters of this genus are the following. The head is somewhat naked; the

Plate CCCLI.

the teeth are in the jaws, palate, and fauces; the body long; the fins of the back, tail, and anus, confounded in one; no fin on the under part of the body; and the eyes covered by the common ſkin. Of this genus there are ſeveral ſpecies, of which the moſt curious is the *ophidium barbatum* of Linnæus, thus deſcribed by Dr Brouſſonet in the 71ſt volume of the Philoſophical Tranſactions.

"The ſcales of the ophidium (ſays he) are irregularly placed and diſperſed over the whole body. Their form is ſometimes round, ſometimes nearly oval. They are larger near the head, and in the lower part of the body; but are hardly to be diſtinguiſhed near the tail. They adhere to the body by means of a particular tranſparent ſkin, which is in general very thin, but ſomewhat thicker near the neck, and extended looſely over the whole head: this ſkin is very eaſily deſtroyed, after which the ſcales falling, the body appears ſpotted (fig. 1.) When you look at them with the naked eye (fig. 2.) they appear as covered with very ſmall grains; but viewed through a microſcope (fig. 3.) the middle of them appears more elevated than the margin; and from the centre to the margin, cloſe by each other, there are many lines or rays formed by ſmall ſcales placed upon one another, like tiles upon a roof, the ſuperior being always the nearer to the centre. This ſort of ſcales, which may be called *umbonatæ*, are faſtened to the body by very ſmall veſſels which are inſerted in their middle; they are to be ſeen on the body only, not on the head nor the fins."

The anatomy of this fiſh comprehends ſome very remarkable circumſtances, which, our author thinks, were never obſerved in any other ſpecies. When the ſkin is drawn off, there appears a thin membrane of a ſilver colour, which covers the muſcles. The muſcles being removed, we find the peritoneum, which lines the abdominal cavity, and is adherent to the ſwimming bladder by ſome elongations. It is of a ſilver hue, with ſome very ſmall black points. The ventricle is not to be diſtinguiſhed from the inteſtines by any other mark but by its ſize; its form is oblong; it is extended almoſt to the anus, from whence the inteſtinal duct has a retrograde courſe, and then deſcends again, having a little dilatation near the anus. On the vertebræ next the anus on the outſide of the peritoneum is a kind of cavity of an [illegible] form, containing a reddiſh viſcus, which he ta[illegible]e the kidney.

The firſt vertebra from the head has nothing very remarkable in its ſtructure. The ſecond has on each ſide an elongated and ſharp apophyſis, to the apex of which is annexed a ſmall ligament. The third is very flat, and has on each ſide a kind of triangular and ſharp apophyſis, to which adheres a ligament, as to the ſecond. The fourth is remarkable in having a ſharp apophyſis on each ſide, articulated with the body of the vertebra; and under each of them is another articulated apophyſis, flattiſh, thick, roundiſh at its extremities, and forked at its baſis (fig. 5.) The fifth, which is ſtrongly adherent to the former, has in its middle a bifid proceſs. The ſixth has in its middle a flattiſh elevation, ſharp on each ſide. Between the extremity of the larger apophyſis of the fourth vertebra is a bone, or rather a hard cartilage, which bears the figure of a kidney (fig. 6.) its convexity being turned towards the body of the vertebra: its poſition is parallel to the bodies of the vertebræ; its motion is half circular; one of its parts, *viz.* the loweſt, being in the cavity of the ſwimming bladder, to which it adheres by a thin membrane, ſo that no air can eſcape at that part. It is covered by membranes, which adhere ſtrongly to its middle; in this part are faſtened the two ligaments of the apophyſis of the ſecond and third vertebræ, of which we ſpoke before, and which are of a great tenuity. In the ſame point are faſtened alſo two ligaments, each of which belongs to an oblong muſcle parallel to each other, and fixed to the bones of the loweſt and poſterior part of the head (fig. 4.)



All this apparatus is certainly ſubſervient to the purpoſe of ſwimming; but it is very remarkable, that if theſe parts are neceſſary to ſome animal function, they ſhould not be found in all the individuals; "for I have ſeen (ſays our author) two, of which the vertebræ were not different from the vertebræ of the other ſpecies: which difference depends, perhaps, on the difference of ſex. I am inclined to believe ſo; but the generation in this fiſh ſeems to be no leſs myſterious than that of the eel: I could never diſtinguiſh a male from a female in this ſpecies."

This fiſh commonly grows to the ſize of eight or nine inches. It is to be found in all the Mediterranean ſea, and in great plenty in the Adriatic: its fleſh is not of a good taſte, rather coarſe, as is that of all the ſpecies of fiſhes which, having no ventral fins, are obliged to make great efforts in ſwimming, and have conſequently the muſcles harder.

OPHIOGLOSSUM, ADDER'S TONGUE: A genus of the natural order of filices, belonging to the cryptogamia claſs of plants. The ſpike is articulated, flat, and turned to the two ſides; with the articuli or joints opening acroſs. There are ſeven ſpecies; of which the only remarkable one is the vulgatum, or common adder's tongue, which is a native of ſeveral places of Britain, growing in meadows and moiſt paſtures. The country people make an ointment of the freſh leaves, and uſe it as a vulnerary to green wounds; which is a very ancient application, recommended by Matthiolus, Tragus, and others.

OPHIOMANCY, in antiquity, the art of making predictions from ſerpents. Thus Calchas, on ſeeing a ſerpent devour eight ſparrows with their dam, foretold the duration of the ſiege of Troy: and the ſeven coils of a ſerpent that was ſeen on Anchiſes's tomb, were interpreted to mean the ſeven years that Æneas wandered from place to place before he arrived at Latium.

OPHIORHIZA, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 47th order, *Stellatæ*. The corolla is funnel-ſhaped; the capſule twin, bilocular, and polyſpermous. There are two ſpecies; the moſt remarkable of which is the Aſiaticum, or true lignum colubrinum. The root of this is known in the Eaſt Indies to be a ſpecific againſt the poiſon of the moſt dreadful animal called the *hooded ſerpent*. There is a treatiſe in *Amœn. Acad.* Tom. IV. upon this ſubject, wherein the author Joh. And. Darelius undertakes, from the deſcription of ſuch authors as had ſeen it upon the ſpot, to aſcertain the plant from which the genuine root is taken. It appears in this account, that it had puzzled the European

ropean physicians; and what had been sold in the shops for it, is the root of a very different plant, and of a poisonous nature.

The true root is called *mungus*, for the following reason.—There is a kind of weasel in the East Indies, called *mungutia* by the natives, *mungo* by the Portuguese, and *muncas* by the Dutch. This animal pursues the hooded serpent, as the cat does the mouse with us. As soon as the serpent appears, the weasel attacks him; and if she chances to be bit by him, she immediately runs to find a certain vegetable, upon eating which, she returns, and renews the fight.—The Indians are of opinion that this plant is the mungos.

That celebrated traveller Kæmpfer, who kept one of these weasels tame, that ate with him, lived with him, and was his companion wherever he went, says he saw one of these battles between her and the serpent, but could not certainly find out what root the weasel looked out for. But whether the weasel first discovered this antidote or not, it is an infallible remedy against the bite of the hooded serpent. And this he undertakes to ascertain.

OPHIOXYLON, in botany: A genus of the monœcia order, belonging to the polygamia class of plants; and in the natural method ranking with those of which the order is doubtful. The hermaphrodite calyx is quinquefid; the corolla quinquefid and funnel-shaped; with a cylindrical nectarium within its mouth.

Different hypotheses respecting the situation of Ophir.

OPHIR, a country mentioned in Scripture, from which Solomon had great quantities of gold brought home in ships which he sent out for that purpose; but where to fix its situation is the great difficulty, authors running into various opinions on that head. Some have gone to the West, others to the East Indies, and the eastern coasts of Africa, in search of it.—Mr Bruce the celebrated Abyssinian traveller has displayed much learning and ingenuity in settling this question of Biblical history. To the satisfaction of most of his readers he has determined Ophir to be Sofala, a kingdom of Africa, on the coast of Mosembique, near Zanguebar (see SOFALA). His reasons for this determination are so generally known, that it would be improper to repeat them here at length; because such as are not already acquainted with them may consult his book, which has been long in the hands of the public. He justly observes, that in order to come to a certainty where this Ophir was, it will be necessary to examine what Scripture says of it, and to keep precisely to every thing like description which we can find there, without indulging our fancy farther. *1st*, Then, the trade to Ophir was carried on from the Elanitic gulf through the Indian ocean. *2dly*, The returns were gold, silver, and ivory, but especially silver †. *3dly*, The time of the going and coming of the fleet was precisely three years ‡, at no period more nor less.

2 Hypothesis of Mr Bruce

Now, if Solomon's fleet sailed from the Elanitic gulf to the Indian ocean, this voyage of necessity must have been made by monsoons, for no other winds reign in that ocean. And what certainly shows this was the case, is the precise term of three years in which the fleet went and came between Ophir and Ezion-gaber.

† 1 Kings x. 22.

‡ 1 Kings, x. 22. 2 Chron. ix. 21.

These mines of Ophir were probably what furnished the East with gold in the earliest times: great traces of excavation must therefore have appeared.

But John dos Santos says, that he landed at Sofala in the year 1586; that he sailed up the great river Cuama as far as Tete, where, always desirous to be in the neighbourhood of gold, his order had placed their convent. Thence he penetrated for above 200 leagues into the country, and saw the gold mines then working at a mountain called *Afura*. At a considerable distance from these are the silver mines of Chicoua; at both places there is a great appearance of ancient excavations; and at both places the houses of the kings are built with mud and straw, whilst there are large remains of massy buildings of stone and lime.

Arguments in support of it.

Every thing then conspires to fix the Ophir of Solomon in the kingdom of Sofala, provided it would necessarily require neither more nor less than three years to make a voyage from Ezion-gaber to that place and Tarshish and return. To establish this important fact, our author observes, that the fleet or ship for Sofala, parting in June from Ezion-gaber (see EZION-GABER), would run down before the northern monsoon to Mocha (see MOCHA). Here, not the monsoon, but the direction of the gulf, changes; and the violence of the south-westers, which then reign in the Indian ocean, make themselves at times felt even in Mocha roads. The vessel therefore comes to an anchor in the harbour of Mocha; and here she waits for moderate weather and a fair wind, which carries her out of the straits of Babelmandel, through the few leagues where the wind is variable.

Her course from this is nearly south-west, and she meets at Cape Gardefan a strong south-wester that blows directly in her teeth. Being obliged to return into the gulf, she mistakes this for a trade-wind; because she is not able to make her voyage to Mocha but by the summer monsoon, which carries her no farther than the straits of Babelmandel, and then leaves her in the face of a contrary wind, a strong current to the northward, and violent swell.

The attempting this voyage with sails, in these circumstances, was absolutely impossible, as their vessels went only before the wind: if it was performed at all, it must have been by oars; and great havock and loss of men must have been the consequence of the several trials.

At last, philosophical observation, together with the unwearied perseverance of man bent upon his own views and interest, removed these difficulties, and showed the mariners of the Arabian gulf, that these periodical winds, which in the beginning they looked upon as invincible barriers to the trading to Sofala, when once understood, were the very means of performing this voyage safely and expeditiously.

The vessel trading to Sofala sailed from the bottom of the Arabian gulf in summer, with the monsoon at north, which carried her to Mocha. There the monsoon failed her by the change of the direction of the gulf. The south-west winds, which blow without Cape Gardefan in the Indian ocean, forced themselves round the cape so as to be felt in the road of Mocha, and make it uneasy riding there. But those soon changed, the weather became moderate, and the vessel, we suppose in the month of August, was safe at anchor

Ophir.

anchor under Cape Gardefan, where was the port which, many years afterwards, was called *Promontorium Aromatum*. Here the ship was obliged to stay all November, because all these summer months the wind south of the cape was a strong south-wester, as hath been before said, directly in the teeth of the voyage to Sofala. But this time was not lost; part of the goods bought to be ready for the return was ivory, frankincense, and myrrh; and the ship was then at the principal mart for these.

Our author supposes, that in November the vessel sailed with the wind at north-east, with which she would soon have made her voyage: but off the coast of Melinda, in the beginning of December, she there met an anomalous monsoon at south-west, in our days first observed by Dr Halley, which cut off her voyage to Sofala, and obliged her to put into the small harbour of Mocha, near Melinda, but nearer still to Tarshish, which we find here by accident, and which we think a strong corroboration that we are right as to the rest of the voyage. In the annals of Abyssinia, it is said that Amda Sion, making war upon that coast in the 14th century, in a list of the rebellious Moorish vassals, mentions the chief of Tarshish as one of them, in the very situation where we have now placed him.

Solomon's vessel, then, was obliged to stay at Tarshish till the month of April of the second year. In May, the wind set in at north-east, and probably carried her that same month to Sofala. All the time she spent at Tarshish was not lost, for part of her cargo was to be brought from that place; and she probably bought, bespoke, or left it there. From May of the second year, to the end of that monsoon in October the vessel could not stir; the wind was north-east. But this time, far from being lost, was necessary to the traders for getting in their cargo, which we shall suppose was ready for them.

The ship sails on her return, in the month of November of the second year, with the monsoon south-west, which in a very few weeks would have carried her into the Arabian gulf. But off Moccha, near Melinda and Tarshish, she met the north-east monsoon, and was obliged to go into that port and stay there till the end of that monsoon; after which a south-wester came to her relief in May of the third year. With the May monsoon she ran to Mocha within the straits, and was there confined by the summer monsoon blowing up the Arabian gulf from Suez, and meeting her. Here she lay till that monsoon which in summer blows northerly from Suez, changed to a south-east one in October or November, and that very easily brought her up into the Elanitic gulf, the middle or end of December of the third year. She had no need of more time to complete her voyage, and it was not possible she could do it in less.

Such is a very short and imperfect abstract of our author's reasons for placing Ophir in Sofala. If it excite the curiosity of our readers to consult his work, it will answer the purpose for which we have made it.

4 Another hypothesis.

We are now to give another ingenious conjecture concerning the situation of Ophir and Tarshish, with which we have been favoured by Dr Doig, the learned author of Letters on the Savage State addressed to Lord Kames.

This respectable writer holds that Ophir was somewhere on the west coast of Africa, and that Tarshish was the ancient Bætica in Spain. His essay is not yet published; but he authorizes us to give the following abstract of it: "The first time that *Ophir*, or rather *Aufir*, occurs in Scripture, is in Gen. x. 29. where the sacred historian, enumerating the sons of Joktan, mentions Aufir as one of them." According to his account, the descendants of those 13 brothers settled all in a contiguous situation, from Mesha (the Mocha of the moderns) to Sepharah, a mountain of the east. Moses, as every one knows, denominates countries, and the inhabitants of countries, from the patriarch of whom those inhabitants descended. In describing the course of one of the branches of the river of paradise, the same Moses informs us that it encompassed the whole land of Havilah, &c. which abounded with fine gold, bdellium, and the onyx stone; and this land had its name from Havilah the 12th son of the patriarch Jotkan. *Ophir* or *Aufir* was Havilah's immediate elder brother; and of course the descendants of the former, in all probability, fixed their habitation in the neighbourhood of those of the latter. If, then, the land of Havilah abounded with gold and precious stones, the land of Ophir undoubtedly produced the very same articles.

5 The original Ophir not the Ophir of Solomon; of which

Here then we have the original Ophir; here was found the primary gold of Ophir; and here lay the Ophir mentioned in Job xi. 24. But as navigation was then in its infant state, the native land of gold mentioned by Job must have been much nearer home than that to which the fleets of Solomon and Hiram made their triennial voyages. That several countries on the south-east coast of Africa abounded with gold long after the era of Job, is evident from the testimony of Herodotus, Strabo, Diodorus Siculus, Ptolemy, Pomponius Mela, &c.; but that in these countries the Ophir of Solomon could not be situated, is plain, because his ships in the same voyage touched at Tarshish, which lay in a very different quarter.

The Abyssinian traveller has placed this *regio aurifera* in Sofala on the eastern coast of Africa, nearly opposite to the island of Madagascar. This hypothesis was current a hundred years before he was born; but I am persuaded (says our author) that it is not tenable. The Ophir of Solomon, in whatever part of Africa it lay, must have been well known, prior to his reign, both to the Phœnicians and the Edomites. These people navigated that monarch's fleet, and therefore could be no strangers to the port whither they were bound. That it was in Africa is certain; and that it was on the west coast of that immense peninsula, will appear more than probable, when we have ascertained the situation of Tarshish, and the usual course of Phœnician navigation. To these objects, therefore, we shall now direct our inquiries.

6 th situation must be ascer- ta by di th Tarshish.

"Javan, the fourth son of the patriarch Japhet, had four sons, Elisha, *Tarshish*, Kittim, and Dodanim or Rodanim; among whose 'descendants were the isles of the Gentiles divided.' The city of *Tarsus* on the coast of Cilicia, at once ascertains the region colonized by the descendants of Tarshish. But as much depends

Ophir.

depends upon determining the poſition of this country, I ſhall endeavour (ſays the Doctor) to fix it with all poſſible preciſion.

"In the firſt place, I muſt beg leave to obſerve, that there is not a ſingle paſſage in any ancient author, ſacred or profane, that ſo much as alludes to any city, diſtrict, canton, or country, of the name of Tarſhiſh in the eaſtern parts of the world. The deſcendants of Javan, of whom Tarſhiſh was one, are agreed on all hands to have extended their ſettlements towards the north-weſt, i. e. into Aſia Minor, Italy, and Spain. The inhabitants of Tarſhiſh are everywhere in Scripture ſaid to be addicted to navigation and commerce, in which they ſeem to have been connected with the Tyrians and Phœnicians †, who were always ſaid by the Jews to inhabit the iſles of the ſea. Indeed, in Hebrew geography, all the countries toward the north and weſt, which were divided from Judea by the ſea, were called the iſles of the ſea ‡. Thus Iſaiah: 'The burden of Tyre. Howl ye ſhips of Tarſhiſh, for it is laid waſte, ſo that there is no houſe, no entering in: from the land of Chittim it is revealed unto them. Be ſtill ye inhabitants of the iſle, thou whom the merchants of Zidon, that paſs over the ſea, have repleniſhed.' The land of Chittim was Macedonia, and often Greece, from which every one knows that the deſtruction of Tyre came; and that Tarſhiſh was not an unconcerned ſpectator of that deſtruction, is obvious from the ſame prophet, who proceeds to ſay ‖. 'As at the report concerning Egypt, ſo ſhall they be ſorely pierced at the report concerning Tyre. Paſs over to Tarſhiſh; howl ye inhabitants of the iſle. Is this your joyous city? It appears likewiſe from Ezekiel *, that Tarſhiſh was the merchant with whom Tyre traded for ſilver, iron, tin, and lead, and that this trade was carried on in fairs.

† Pſ. xlviii. 7. lxxii. 10.

‡ Gen. ii. 26.

‖ Iſ. xxiii. *paſſim.*

The original Tarſhiſh where ſituated.

"From all theſe paſſages, it ſeems to be evident, that the deſcendants of Tarſhiſh ſettled on the weſtern coaſt of Aſia Minor; that theſe people were addicted to navigation and commerce; that in the courſe of their traffic they were connected with the Tyrians and Phœnicians; that the commerce they carried on conſiſted of ſilver, iron, tin, and lead; that the people of Tarſhiſh were connected with Kittim and the iſles of the Gentiles, which are confeſſedly ſituated toward the north and weſt of Judea.

"But leaſt, after all, a fact ſo fully authenticated ſhould ſtill be called in queſtion, I ſhall add one proof more, which will place the matter beyond the reach of doubt and controverſy.

"When the prophet Jonah intended to flee from the preſence of the Lord, in order to avoid preaching at Nineveh, let us ſee where the peeviſh deſerter embarked. (Jonah i. 3.) "And Jonah roſe up to flee unto Tarſhiſh, from the preſence of the Lord, and went down to Joppa; and he found a ſhip going to Tarſhiſh, and he paid the fare thereof, and went down into it, to go with them into Tarſhiſh, from the preſence of the Lord.' Every body knows that Joppa or Japhah ſtood upon the ſhore of the Mediterranean; of courſe the fugitive prophet had determined to go to ſome very diſtant region weſtward, and by that means to get as far from Nineveh as poſſible."

This not the Tarſhiſh of Solomon.

Having thus proved to a demonſtration, that the original Tarſhiſh was a region on the weſtern coaſt of Aſia Minor, where either the patriarch of that name, or ſome of his immediate deſcendants, planted a colony, it remains to determine whether this was actually the country from which Solomon imported the vaſt quantities of ſilver mentioned by the ſacred hiſtorian. That it was not, our author frankly acknowledges; and therefore, ſays he, we muſt look out for Solomon's Tarſhiſh in ſome other quarter of the globe.

To pave the way for this diſcovery, he very juſtly obſerves, that it has at all times been a common practice to transfer the name of one country to another, in conſequence of ſome analogy or reſemblance between them. It has likewiſe often happened, that when a commodity was brought from a very diſtant country by a very diſtant people, the people to whom it was imported have taken it for granted that it was produced in the region from which it was immediately brought to them. Of the truth of this poſition no man acquainted with the Greek and Roman poets can for a moment entertain a doubt. Hence the *Aſſyrium amomum* of Virgil, and the *Aſſyrium malabathrum* of Horace, though theſe articles were the product not of Aſſyria but of India. The Jews, who were as little acquainted with foreign countries as the Greeks and Romans, had very probably the ſame notions with them reſpecting articles of commerce; and if ſo, they would undoubtedly ſuppoſe, that the ſilver, ſold by the merchants of Tarſhiſh was the product of that country. When this miſtake came to be diſcovered, they very naturally transferred the name *Tarſhiſh* from the country of the merchants to that of the articles which they imported. Let us now, ſays our author, try if we cannot find out where that country was.

9

The name of one country transferred to another.

It has been already ſhown, by quotations from Iſaiah and Ezekiel, that the merchants of Tarſhiſh traded in the markets of Tyre with ſilver, iron, lead, and tin. To theſe authorities, we ſhall add another from Jeremiah: "Silver (ſays that prophet) ſpread into plates is brought from Tarſhiſh." "But in Spain (continues our learned diſſertator), all thoſe commodities were found in the greateſt abundance. All the ancient authors who deſcribe that region dwell with rapture on its ſilver mines. This fact is too generally known to need to be ſupported by authorities. Spain was then the region which furniſhed Solomon's traders with the immenſe maſs of ſilver he is ſaid to have imported. This was, one might ſay, the modern Tarſhiſh; and indeed both Joſephus and Euſebius are poſitive that the poſterity of Tarſhiſh actually peopled that country. If this was an early opinion, as it certainly was, the Jews would of courſe denominate Spain from the patriarch in queſtion.

"I have ſhown above, that the inhabitants of Tarſhiſh were ſtrictly connected with the Kittim, or Grecians: I ſhall here produce an authority which will prove to a demonſtration that the Kittim had extended their commerce into that part of Africa now called Barbary.

"The prophet Ezekiel, (xxvii. 6.) deſcribing the ſplendour and magnificence of Tyre, tells us, 'that the company of the Aſhurites made her benches of ivory, brought from the iſles of Kittim.' In the firſt place, I muſt obſerve, that there is probably a ſmall error in the orthography of the word Aſhurim. This term is everywhere in Scripture tranſlated Aſſyrians, which

entertained any doubt concerning the same property in flint glass, the effect of which is three times as great as crown glass. One may observe, however, in these kinds of glass, something of a proportion between the mean refraction and the dispersion of rays, which may enable us to reconcile these surprising effects with other principles already known.

Here, however, M. Euler announces to us another discovery of the same M. Zeiher, no less surprising than the former, and which disconcerted all his schemes for reconciling the above-mentioned phenomena. As the six kinds of glass mentioned in the above table were composed of nothing but minium and flint, M. Zeiher happened to think of mixing alkaline salts with them, in order to give the glass a consistence more proper for dioptric uses; when he was much surprised to find this mixture greatly diminished the mean refraction, almost without making any change in the dispersion. After many trials, he at length obtained a kind of glass greatly superior to the flint glass of Mr Dollond, with respect to the construction of telescopes; since it occasioned three times as great a dispersion of the rays as the common glass, at the same time that the mean refraction was only as 1.61 to 1.

M. Euler also gives particular instructions how to find both the mean and extreme refractive power of different kinds of glass; and particularly advises to make use of prisms with very large refracting angles, not less than 70°.

Notwithstanding it evidently appeared, we may say, to almost all philosophers, that Mr Dollond had made a real discovery of something not comprehended in the optical principles of Sir Isaac Newton, it did not appear so to Mr Murdoch. Upon this occasion, he interposed in the defence, as he imagined, of Sir Isaac Newton; maintaining, that Mr Dollond's positions, which, he says, he knows not by what mishap have been deemed paradoxes in Sir Isaac's theory of light, are really the necessary consequences of it. He also endeavours to show that Sir Isaac might not be mistaken in his account of the experiment above mentioned. But, admitting all that he advances in this part of his defence, Newton must have made use of a prism with a much smaller refracting angle than, from his own account of his experiments, we have any reason to believe that he ever did make use of.

The fact probably was, that Sir Isaac deceived himself in this case, by attending to what he imagined to be the clear consequence of his other experiments; and though the light he saw was certainly tinged with colours, and he must have seen it to be so, yet he might imagine that this circumstance arose from some imperfection in his prisms, or in the disposition of them, which he did not think it worth his while to examine. It is also observable, that Sir Isaac is not so particular in his description of his prisms, and other parts of his apparatus, in his account of his experiment, as he generally is in other cases; and therefore, probably, wrote his account of it from his memory only. In reality, it is no reflection upon Sir Isaac Newton, who did so much, to say that he was mistaken in this particular case, and that he did not make the discovery that Mr Dollond did; though it be great praise to Mr Dollond, and all those persons who contributed to this discovery, that they ventured to call in question the authority of so great a man.

Mr Dollond, however, was not the only optician who had the merit of making this discovery; it had been made and applied to the same purpose by a private gentleman—Mr Chest of Chest hall. He had observed that prisms of flint glass gave larger spectrums than prisms of water when the mean refraction was the same in both, i. e. when the deviation of the refracted ray from the direction of the incident was the same. He tried prisms of other glass, and found similar differences; and he employed the discovery in the same manner, and made achromatic experiments some time before Dollond. These facts came out in a process raised at the instance of Watkins optician at Charing-cross, as also in a publication by Mr Ramsden optician. There is, however, no evidence that Dollond stole the idea from Mr Chest, or that they had not both claims to the discovery.

Still the best refracting telescopes, constructed on the principles of Mr Dollond, are defective, on account of that colour which, by the aberration of the rays, they give to objects viewed through them, unless the object glass be of small diameter. This defect men of genius and science have laboured to remove, some by one contrivance and some by another. Father Boscovich, to whom every branch of optics is much indebted, has, in his attempts for this purpose, displayed much ingenuity; but the philosopher whose exertions have been crowned with most success, and who has perhaps made the most important discovery in this branch of science since the era of Newton, is Dr Robert Blair regius professor of astronomy in the college of Edinburgh. By a judicious set of experiments ably conducted, he has proved, that the quality of dispersing the rays in a greater degree than crown glass, is not confined to a few mediums, but is possessed by a great variety of fluids, and by some of these in a most extraordinary degree. He has shown, that although the greater refrangibility of the violet rays than of the red rays, when light passes from any medium whatever into a vacuum, may be considered as a law of nature; yet in the passages of light from one medium into another, it depends entirely on the qualities of the mediums which of these rays shall be the most refrangible, or whether there shall be any difference in their refrangibility. In order to correct the aberration arising from difference of refrangibility among the rays of light, he instituted a set of experiments, in the conducting of which he detected a very singular and important quality in the muriatic acid. In all the dispersive mediums hitherto examined, the green rays, which are the mean refrangible in crown glass, were found among the less refrangible; but in the muriatic acid, these same rays were by him found to make a part of the more refrangible. This discovery led to complete success in removing the great defect of optical instruments, viz. that dissipation or aberration of the rays which arise from their unequal refrangibility, and has hitherto rendered it impossible to converge all of them to one point either by single or opposite refractions. A fluid, in which the particles of marine acid and metalline particles hold a due proportion, at the same time that it separates the extreme rays of the spectrum

19 Discovery of Dr Robert Blair for this purpose.

spectrum much more than crown glass, refracts all the orders of the rays in the same proportion that glass does: and hence rays of all colours made to diverge by the refraction of the glass, may either be rendered parallel by a subsequent refraction made in the confine of the glass and this fluid; or, by weakening the refractive density of the fluid, the refraction which takes place in the confine of it and glass may be rendered as regular as reflexion, without the least colour whatever. The Doctor has a telescope, not exceeding 15 inches in length, with a compound object glass of this kind, which equals in all respects, if it does not surpass, the best of Dollond's 42 inches long. Of this object glass a figure will be found in the third volume of the Transactions of the Royal Society of Edinburgh; and to that volume we must refer our readers for a full and perspicuous account of the experiments which led to this discovery, as well as of the important purposes to which it may be applied.

20 Of the refraction of the atmosphere.

We shall conclude the history of the discoveries concerning refraction, with some account of the refractions of the atmosphere.—Tables of this have been calculated by Mr Lambert, with a view to correct the inaccuracies of geometrical observations of the altitudes of mountains. The observations of Mr Lambert, however, go upon the supposition that the refractive power of the atmosphere is invariable: But this is by no means the case; and therefore his rules must be considered as true for the mean state of the air only.

A most remarkable variety in the refractive power of the atmosphere was observed by Dr Nettleton, near Halifax in Yorkshire, which demonstrates how little we can depend upon the calculated heights of mountains, when the observations are made with an instrument, and the refractive power of the air is to be allowed for. Being desirous to learn, by observation, how far the mercury would descend in the barometer at any given elevation (for which there is the best opportunity in that hilly country), he proposed to take the height of some of their highest hills; but when he attempted it, he found his observation so much disturbed by refraction, that he could come to no certainty. Having measured one hill of a considerable height, in a clear day, and observed the mercury at the bottom and at the top, he found, according to that estimation, that about 50 feet or more were required to make the mercury fall $\frac{1}{10}$th of an inch; but afterwards, repeating the experiment on a cloudy day, when the air was rather gross and hazy, he found the small angles so much increased by refraction as to make the hill much higher than before. He afterwards frequently made observations at his own house, by pointing a quadrant to the tops of some neighbouring hills, and observed that they would appear higher in the morning before sunrise, and also late in the evening, than at noon in a clear day, by several minutes. In one case the elevations of the same hill differed more than 30 minutes. From this he infers, that observations made on very high hills, especially when viewed at a distance, and under small angles, as they generally are, are probably uncertain, and not much to be depended upon.

M. Euler considered with great accuracy the refractive power of the atmosphere, as affected by different degrees of heat and elasticity; in which he shows, that its refractive power, to a considerable distance from the zenith, is sufficiently near the proportion of the tangent of that distance, and that the law of refraction follows the direct ratio of the height of the barometer, and the inverse ratio of the difference marked by the thermometer; but when stars are in the horizon, the changes are in a ratio somewhat greater than this, more especially on account of the variation in the heat.

21 Mr Michell's opinion concerning the twinkling of the stars.

The cause of the twinkling of the stars is now generally acknowledged to be the unequal refraction of light, in consequence of inequalities and undulations in the atmosphere.

Mr Michell supposes that the arrival of fewer or more rays at one time, especially from the smaller or the more remote fixed stars, may make such an unequal impression upon the eye, as may, at least, have some share in producing this effect; since it may be supposed, that even a single particle of light is sufficient to make a sensible impression upon the organs of sight; so that very few particles arriving at the eye in a second of time, perhaps no more than three or four, may be sufficient to make an object constantly visible. For though the impression may be considered as momentary, yet the perception occasioned by it is of some duration. Hence, he says, it is not improbable that the number of the particles of light which enter the eye in a second of time, even from Sirius himself (the light of which does not exceed that of the smallest visible fixed star, in a greater proportion than that of about 1000 to 1), may not exceed 3000 or 4000, and from stars of the second magnitude they may, therefore, probably not exceed 100. Now the apparent increase and diminution of the light which we observe in the twinkling of the stars, seems to be repeated at not very unequal intervals, perhaps about four or five times in a second. He therefore thought it reasonable to suppose, that the inequalities which will naturally arise from the chance of the rays coming sometimes a little denser, and sometimes a little rarer, in so small a number of them as must fall upon the eye in the fourth or fifth part of a second, may be sufficient to account for this appearance. An addition of two or three particles of light, or perhaps a single one, upon 20, especially if there should be an equal deficiency out of the next 20, would, he supposed, be very sensible, as he thought was probable from the very great difference in the appearance of stars, the light of which does not differ so much as is commonly imagined. The light of the middlemost star in the tail of the Great Bear does not, he thinks, exceed the light of the very small star that is next to it in a greater proportion than that of about 16 or 20 to 1; and M. Bouguer found, that a difference in the light of objects of one part in 66 was sufficiently distinguishable.

It will perhaps, he says, be objected, that the rays coming from Sirius are too numerous to admit of a sufficient inequality arising from the common effect of chance so frequently as would be necessary to produce this effect, whatever might happen with respect to the smaller stars; but he observes, that, till we know what inequality is necessary to produce this effect, we can only guess at it one way or the other.

Since these observations were published, Mr Michell has entertained some suspicion that the unequal density

ſity of light does not contribute to this effect in ſo great degree as he had imagined, eſpecially in conſequence of obſerving that even Venus does ſometimes twinkle. This he once obſerved her to do remarkably when was ſhe about 6 degrees high, though Jupiter, which was then about 16 degrees high, and was ſenſibly leſs luminous, did not twinkle at all. If, notwithſtanding the great number of rays which, no doubt, come to the eye from ſuch a ſurface as this planet preſents, its appearance be liable to be affected in this manner, it muſt be owing to ſuch undulations in the atmoſphere, as will probably render the effect of every other cauſe altogether inſenſible. The conjecture, however, has ſo much probability in it, that it well deſerved to be recited.

22 M. Muſchenbroek's opinion.

M. Muſchenbroek ſuſpects, that the twinkling of the ſtars ariſes from ſome affection of the eye, as well as the ſtate of the atmoſphere. For he ſays, that in Holland, when the weather is froſty, and the ſky very clear, the ſtars twinkle moſt manifeſtly to the naked eye, though not in teleſcopes; and ſince he does not ſuppoſe that there is any great exhalation, or dancing of the vapour at that time, he queſtions whether the vivacity of the light affecting the eye may not be concerned in the phenomenon.

But this philoſopher might very eaſily have ſatisfied himſelf with reſpect to this hypotheſis, by looking at the ſtars near the zenith, when the light traverſes but a ſmall part of the atmoſphere, and therefore might be expected to affect the eye the moſt ſenſibly. For he would not have perceived them to twinkle near ſo much, as they do near the horizon, when much more of their light is intercepted by the atmoſphere.

Some aſtronomers have lately endeavoured to explain the twinkling of the fixed ſtars by the extreme minuteneſs of their apparent diameter; ſo that they ſuppoſe the ſight of them is intercepted by every mote that floats in the air. But Mr Michell obſerves, that no object can hide a ſtar from us that is not large enough to exceed the apparent diameter of the ſtar, by the diameter of the pupil of the eye; ſo that if a ſtar was a mathematical point, the interpoſing object muſt ſtill be equal in ſize to the pupil of the eye: nay, it muſt be large enough to hide the ſtar from both eyes at the ſame time.

Beſides a variation in the quantity of light, a momentary change of colour has likewiſe been obſerved in ſome of the fixed ſtars. Mr Melville ſays, that when one looks ſtedfaſtly at Sirius, or any bright ſtar not much elevated above the horizon, its colour ſeems not to be conſtantly white, but appears tinctured, at every twinkling, with red and blue. This obſervation Mr Melville puts among his queries, with reſpect to which he could not entirely ſatisfy himſelf; and he obſerves, that the ſeparation of the colours by the refractive power of the atmoſphere is, probably, too ſmall to be perceived. But the ſuppoſition of Mr Michell above-mentioned will pretty well account for this circumſtance, though it may be thought inadequate to the former caſe. For the red and blue rays being much fewer than thoſe of the intermediate colours, and therefore much more liable to inequalities, from the common effect of chance, a ſmall exceſs or defect in either of them will make a very ſenſible difference in the colour of the ſtars.

### § 3. *Diſcoveries concerning the Reflection of Light*

23 Account of the diſcoveries of the ancients.

However much the ancients might have been miſtaken with regard to the nature of light, we find that they were acquainted with two very important obſervations concerning it; viz. that light is propagated in right lines, and that the angle of incidence is equal to the angle of reflection. Who it was that firſt made theſe important obſervations is not known. But indeed, important as they are, and the foundation of a great part of even the preſent ſyſtem of optics, it is poſſible that, if he were known, he might not be allowed to have any ſhare of merit, at leaſt for the *former* of them; the fact is ſo very obvious, and ſo eaſily aſcertained. As to the latter, that *the angle of incidence is equal to the angle of reflection*, it was probably firſt diſcovered by obſerving a ray of the ſun reflected from the ſurface of water, or ſome other poliſhed body; or from obſerving the images of objects reflected by ſuch ſurfaces. If philoſophers attended to this phenomenon at all, they could not but take notice, that, if the ray fell nearly perpendicular upon ſuch a ſurface, it was reflected near the perpendicular; and if it fell obliquely, it was reflected obliquely: and if they thought applying any kind of meaſures to theſe angles, however coarſe and imperfect, they could not but ſee that there was ſufficient reaſon to aſſert their equality. At the ſame time they could not but know that the incident and reflected rays were both in the ſame plane.

Ariſtotle was ſenſible that it is the reflection of light from the atmoſphere which prevents total darkneſs after the ſun ſets, and in places where he doth not ſhine in the day time. He was alſo of opinion, that rainbows, halos, and mock ſuns, were all occaſioned by the reflection of the ſun beams in different circumſtances by which an imperfect image of his body was produced, the colour only being exhibited, and not his proper figure. The image, he ſays, is not ſingle, as in a mirror; for each drop of rain is too ſmall to reflect a viſible image, but the conjunction of all the images is viſible.

24 Euclid's treatiſe of optics.

Without inquiring any farther into the nature of light or viſion, the ancient geometricians contented themſelves with deducing a ſyſtem of optics from the two obſervations mentioned above, viz. the rectilinear progreſs of light, and the equality of the angles of incidence and reflection. The treatiſe of optics which has been aſcribed to Euclid is employed about determining the apparent ſize and figure of objects, from the angle under which they appear, or which the extremities of them ſubtend at the eye, and the apparent place of the image of an object reflected from a poliſhed miror; which he fixes at the place where the reflected ray meets a perpendicular to the miror drawn through the object. But this work is ſo imperfect, and ſo inaccurately drawn up, that it is not generally thought to be the production of that great geometrician.

25 Of the burning glaſſes of the ancients.

It appears from a circumſtance in the hiſtory of Socrates, that the effects of burning glaſſes had alſo been obſerved by the ancients; and it is probable that the Romans had a method of lighting their ſacred fire by means of a concave ſpeculum. It ſeems indeed to have been known pretty early, that there is an in-

crease of heat in the place where the rays of light meet, when they are reflected from a concave mirror. The burning power of concave mirrors is taken notice of by Euclid in the second book of the treatise abovementioned. If we give but a small degree of credit to what some ancient historians are said to have written concerning the exploits of Archimedes, we shall be induced to think that he made great use of this principle, in constructing some very powerful burning mirrors: but nothing being said of other persons making use of his inventions, the whole account is very doubtful. It is allowed, however, that this eminent geometrician did write a treatise on the subject of burning mirrors, though it be not now extant.

B. Porta supposes that the burning mirrors of the ancients were of metal, in the form of a section of a parabola. It follows from the properties of this curve, that all the rays which fall upon it, parallel to its axis, will meet in the same point at the focus. Consequently, if the vertex of the parabola be cut off, as in fig. 1. it will make a convenient burning mirror. In some drawings of this instrument the frustum is so small, as to look like a ring. With an instrument of this kind, it is thought, that the Romans lighted their sacred fire. Some have also thought that this was the form of the mirror with which Archimedes burnt the Roman fleet; using either a lens, to throw the rays parallel, when they had been brought to a focus; or applying a smaller parabolic mirror for this purpose, as is represented fig. 2. But Dechales shows, that it is impossible to convey any rays in a direction parallel to one another, except those that come from the same point in the sun's disk.

Plate CCCLII.

26 Of seeing images in the air.

All this time, however, the nature of reflection was very far from being understood. Even Lord Bacon, who made much greater advances in natural philosophy than his predecessors, and who pointed out the true method of improving it, was so far deceived with regard to the nature of reflection and refraction, that he supposed it possible to see the image reflected from a looking glass, without seeing the glass itself; and to this purpose he quotes a story of Friar Bacon, who is reported to have apparently walked in the air between two steeples, and which was thought to have been effected by reflection from glasses while he walked upon the ground.

The whole business of seeing images in the air may be traced up to Vitellio; and what he said upon the subject seems to have passed from writer to writer, with considerable additions, to the time of Lord Bacon. What Vitellio endeavours to show is, that it is possible, by means of a cylindrical convex speculum, to see the images of objects in the air, out of the speculum, when the objects themselves cannot be seen. But, if his description of the apparatus requisite for this experiment be attended to, it will be seen that the eye was to be directed towards the speculum, which was placed within a room, while both the object and the spectator were without it. But though he recommends this observation to the diligent study of his readers, he has not described it in such a manner as is very intelligible; and, indeed, it is certain, that no such effect can be produced by a convex mirror. If he himself did make any trial with the apparatus that he describes for this purpose, he must have been under some deception with respect to it.

B. Porta says, that this effect may be produced by a plane mirror only; and that an ingenious person may succeed in it: but his more particular description of a method to produce this extraordinary appearance is by a plane mirror and a concave one combined.

Kircher also speaks of the possibility of exhibiting these pendulous images, and supposes that they are reflected from the dense air: and the most perfect and pleasing deception depending upon the images in the air is one of which this writer gives a particular account in his *Ars Magna Lucis et Umbræ*, p. 783. In this case the image is placed at the bottom of a hollow polished cylinder, by which means it appears like a real solid substance, suspended within the mouth of the vessel. In this manner, he says, he once exhibited a representation of the ascension of Christ; when the images were so perfect, that the spectators could not be persuaded, but by attempting to handle them, that they were not real substances.

Among other amusing things that were either invented or improved by Kircher, was the method of throwing the appearance of letters, and other forms of things, into a darkened room from without, by means of a lens and a plane mirror. The figures or letters were written upon the face of the mirror, and inverted, and the focus of the lens was contrived to fall upon the screen or wall that received their images. In this manner, he says, that with the light of the sun he could throw a plain and distinct image 500 feet.

27 Discoveries of Kepler.

It was Kepler who first discovered the true reason of the apparent places of objects seen by reflecting mirrors, as it depends upon the angle which the rays of light, issuing from the extreme part of an object, make with one another after such reflections. In plane mirrors these rays are reflected with the same degree of inclination to one another that they had before their incidence; but he shows that this inclination is changed in convex and concave mirrors.

28 Of Mr Boyle.

Mr Boyle made some curious observations concerning the reflecting powers of differently coloured substances. Many learned men, he says, imagined that snow affects the eyes, not by a *borrowed*, but by a *native* light; but having placed a quantity of snow in a room, after which all foreign light was excluded, neither he nor any body else was able to perceive it. To try whether white bodies reflect more light than others, he held a sheet of white paper in a sun beam admitted into a darkened room; and observed that it reflected much more light than a paper of any other colour, a considerable part of the room being enlightened by it. Farther, To show that white bodies reflect the rays outwards, he adds, that common burning glasses will not of a long time burn or discolour white paper. When he was a boy, he says, and took great pleasure in making experiments with these glasses, he was much surprised at this remarkable circumstance; and it set him very early upon guessing at the nature of whiteness, especially as he observed that the image of the sun was not so well defined upon white paper as upon black; and as, when he put ink upon the paper, the moisture would be quickly dried up, and the paper, which he could not burn before, would presently take fire.

fire. He alfo found, that, by expofing his hand to the fun, with a thin black glove upon it, it would be fuddenly and more confiderably heated, than if he held his naked hand to the rays, or put on a glove of thin white leather.

To prove that black is the reverfe of white, with refpect to its property of reflecting the rays of the fun, he procured a large piece of black marble; and having got it ground into the form of a large fpherical concave fpeculum, he found that the image of the fun reflected from it was far from offending or dazzling his eyes, as it would have done from another fpeculum; and though this was large, he could not in a long time fet a piece of wood on fire with it; though a far lefs fpeculum, of the fame form, and of a more reflecting fubftance, would prefently have made it flame.

To fatisfy himfelf ftill farther with refpect to this fubject, he took a broad and large tile; and having made one half of its furface white and the other black, he expofed it to the fummer fun. And having let it lie there fome time, he found, that while the whited part remained cool, the part that was black was grown very hot. For his farther fatisfaction, he fometimes left part of the tile of its native red; and, after expofing the whole to the fun, obferved that this part grew hotter than the white, but was not fo hot as the black part. He alfo obferves, that rooms hung with black are not only darker than they would otherwife be, but warmer too; and he knew feveral perfons, who found great inconvenience from rooms hung with black. As another proof of his hypothefis, he informs us, that a virtuofo, of unfufpected credit, acquainted him, that, in a hot climate, he had feen eggs well roafted in a fhort time, by firft blacking the fhells, and then expofing them to the fun.

29
Of the infufion of lignum nephriticum.

We have already taken notice of the remarkable property of lignum nephriticum firft obferved by Kircher. (See GUILANDINA.) However, all his obfervations with regard to it fell very fhort of Mr Boyle. He defcribes this lignum nephriticum to be a whitifh kind of wood, that was brought from Mexico, which the natives call *coatl* or *tlapazatli*, and which had been thought to tinge water of a green colour only; but he fays that he found it to communicate all kinds of colours. If, fays he, an infufion of this wood be put into a glafs globe, and expofed to a ftrong light, it will be as colourlefs as pure water; but if it be carried into a place a little fhaded, it will be a moft beautiful green. In a place ftill more fhaded, it will incline to red; and in a very fhady place, or in an opaque veffel, it will be green again.

A cup of this remarkable wood was fent to Kircher by the procurator of his fociety at Mexico, and was prefented by him to the emperor as a great curiofity. It is called *lignum nephriticum*, becaufe the infufion of it was imagined to be of fervice in difeafes of the kidneys and bladder, and the natives of the country where it grows do make ufe of it for that purpofe.

Mr Boyle corrected feveral of the hafty obfervations of Kircher concerning the colours that appear in the infufion of lignum nephriticum, and he diverfified the experiments with it in a very pleafing manner. He firft diftinctly noted the two very different colours which this remarkable tincture exhibits by tranfmitted and reflected light. If, fays he, it be held directly between the light and the eye, it will appear tinged (excepting the very top of it, where a fky coloured circle fometimes appears) almoft of a golden colour, except the infufion be too ftrong; in which cafe it will be dark or reddifh, and requires to be diluted with water. But if it be held from the light, fo that the eye be between the light and the phial, it will appear of a deep lively blue colour; as will alfo the drops, if any lie on the outfide of the glafs.

When a little of this tincture was poured upon a fheet of white paper, and placed in a window where the fun could fhine upon it, he obferved, that if he turned his back upon the fun, the fhadow of his pen, or any fuch flender fubftance, projected upon the liquor, would not be all dark, like other fhadows; but that part of it would be curioufly coloured, the edge of it next the body being almoft of a lively golden colour, and the more remote part blue. Thefe, and other experiments of a fimilar nature, many of his friends, he fays, beheld with wonder; and he remembered an excellent oculift, who accidentally meeting with a phial full of this liquor, and being unacquainted with this remarkable property of it, imagined, after he had viewed it a long time, that fome new and ftrange diftemper had feized his eyes: and Mr Boyle himfelf acknowledges, that the oddnefs of this phenomenon made him very defirous to find out the caufe of it; and his inquiries were not altogether unfuccefsful.

Obferving that this tincture, if it were too deep, was not tinged in fo beautiful a manner, and that the impregnating virtue of the wood did, by being frequently infufed in frefh water, gradually decay, he conjectured that the tincture contained much of the effential falt of the wood; and to try whether the fubtle parts, on which the colour depended, were volatile enough to be diftilled, without diffolving their texture, he applied fome of it to the gentle heat of a lamp furnace; but he found all that came over was as limpid and colourlefs as rock water, while that which remained behind was of fo deep a blue, that it was only in a very ftrong light that it appeared of any colour.

Sufpecting that the tinging particles abounded with falts, whofe texture, and the colour thence arifing, would probably be altered by acids, he poured into a fmall quantity of it a very little fpirit of vinegar, and found that the blue colour immediately vanifhed, while the golden one remained, on which ever fide it was viewed with refpect to the light.

Upon this he imagined, that as the acid falts of the vinegar had been able to deprive the liquor of its blue colour, a fulphureous falt, which is of a contrary nature, would deftroy their effects; and having placed himfelf betwixt the window and the phial, and let fall into the fame liquor a few drops of oil of tartar *per deliquium*, he found that it was immediately reftored to its former blue colour, and exhibited all the fame phenomena which it had done at the firft.

Having fometimes brought a round long-necked phial, filled with this tincture, into a darkened room, into which a beam of the fun was admitted by a fmall aperture; and holding the phial fometimes near the fun beams, and fometimes partly in them and partly

out

out of them, changing also the position of the glass, and viewing it from several parts of the room, it exhibited a much greater variety of colours than it did in an enlightened room. Besides the usual colours, it was red in some places and green in others, and within were intermediate colours produced by the different degrees and odd mixtures of light and shade.

It was not only in this tincture of lignum nephriticum that Mr Boyle observed the difference between reflected and transmitted light. He observed it even in gold, though no person explained the cause of these effects before Sir Isaac Newton. He took a piece of leaf gold, and holding it betwixt his eye and the light, observed, that it did not appear of a golden colour, but of a greenish blue. He also observed the same change of colour by candle light; but the experiment did not succeed with a leaf of silver.

The constitution of the atmosphere and of the sea, we shall find, by observations made in later periods, to be similar to that of this infusion; for the blue rays, and others of a faint colour, do not penetrate so far into them as the red, and others of a stronger colour: but what this constitution is, which is common to them all, deserves to be inquired into. For almost all other tinctures, and this of lignum nephriticum too, after some change made in it by Mr Boyle, as well as all other semi-transparent coloured substances, as glass, appear of the same hue in all positions of the eye. To increase or diminish the quantity makes no difference, but to make the colour deeper or more dilute.

30
Mr Boyle's account of the colours of thin plates.

The first distinct account of the colours exhibited by thin plates of various substances, are met with among the observations of Mr Boyle. To show the chemists that colours may be made to appear or vanish, where there is no accession or change either of the sulphureous, the saline, or the mercurial principle of bodies, he observes, that all chemical essential oils, as also good spirit of wine, being shaken till they rise in bubbles, appear of various colours; which immediately vanish when the bubbles burst, so that a colourless liquor may be immediately made to exhibit a variety of colours, and lose them in a moment, without any change in its essential principles. He then mentions the colours that appear in bubbles of soap and water, and also in turpentine. He sometimes got glass blown so thin as to exhibit similar colours; and observes, that a feather, of a proper shape and size, and also a black ribbon, held at a proper distance, between his eye and the sun, showed a variety of little rainbows, as he calls them, with very vivid colours, none of which were constantly to be seen in the same objects.

31
Dr Hooke's account of these colour

Much more pains were taken with this subject, and a much greater number of observations respecting it were made, by Dr Hooke. As he loved to give surprise by his discoveries, he promised, at a meeting of the society on the 7th of March 1672, to exhibit, at their next meeting, something which had neither reflection nor refraction, and yet was diaphanous. Accordingly, at the time appointed, he produced the famous coloured bubble of soap and water, of which such admirable use was afterwards made by Sir Isaac Newton, but which Dr Hooke and his contemporaries seem to have overlooked in Mr Boyle's treatise on colours, though it was published nine years before. It is no wonder that so curious an appearance excited the attention of that inquisitive body, and that they should desire him to bring an account of it in writing at their next meeting.

By the help of a small glass pipe, there were blown several small bubbles, out of a mixture of soap and water; where it was observable, that, at first, they appeared white and clear; but that, after some time, the film of water growing thinner, there appeared upon it all the colours of the rainbow: First, a pale yellow; then orange, red, purple, blue, green, &c. with the same series of colours repeated; in which it was farther observable, that the first and last series were very faint, and that the middlemost order or series were very bright. After these colours had passed over the changes above-mentioned, the film of the bubble began to appear white again; and presently, in several parts of this second white film, there appeared several holes, which by degrees grew very big, several of them running into one another. After reciting other observations, which are not of much consequence, he says it is strange, that though both the encompassing and encompassed air have surfaces, yet he could not observe that they afforded either reflection or refraction, which all the other parts of the encompassed air did. This experiment, he says, at first sight, may appear very trivial, yet, as to the finding out the nature and cause of reflection, refraction, colours, congruity and incongruity, and several other properties of bodies, he looked upon it as one of the most instructive. And he promised to consider it more afterwards; but we do not find that ever he did; nor indeed is it to be much regretted, as we shall soon find this business in better hands. He adds, that that which gives one colour by reflection, gives another by trajection; not much unlike the tincture of lignum nephriticum.

Dr Hooke was the first to observe, if not to describe, the beautiful colours that appear in thin plates of Muscovy glass. These he says, are very beautiful to the naked eye, but much more when they are viewed with a microscope. With this instrument he could perceive that these colours were ranged in rings surrounding the white specks or flaws in this thin substance, that the order of the colours were the very same as in the rainbow, and that they were often repeated ten times. But the colours, he says, were disposed as in the outer bow, and not the inner. Some of them also were much brighter than others, and some of them very much broader. He also observed, that if there was a place where the colours were very broad, and conspicuous to the naked eye, they might be made, by pressing the place with the finger, to change places, and move from one part to another. Lastly, He observed, that if great care be used, this substance may split into plates of $\frac{1}{8}$ or $\frac{1}{6}$ of an inch in diameter, each of which will appear through a microscope to be uniformly adorned with some one vivid colour, and that these plates will be found upon examination to be of the same thickness throughout.

As a fact similar to this, but observed previous to it, we shall here mention that Lord Brereton, at a meeting of the Royal Society in 1666, produced some

pieces

pieces of glass taken out of a window of a church, both on the north and on the south side of it; observing, that they were all eaten in by the air, but that the piece taken from the south side had some colours like those of the rainbow upon it, which the others on the north side had not. This phenomenon has been frequently observed since, and in other circumstances. It is not to be doubted, but that in all these cases, the glass is divided into thin plates, which exhibit colours, upon the same principle with those which Dr Hooke observed in the bubble of soap and water, and in the thin plate of glass, which we shall find more fully explained by Sir Isaac Newton. With care the thin plates of the glass may be separated, and the theory verified.

32 Why the stars are visible by day at the bottom of a well.

An observation made by Otto Guericke, well explains the reason why stars are visible at the bottom of a deep well. It is, says he, because the light that proceeds from them is not overpowered by the rays of the sun, which are lost in the number of reflections which they must undergo in the pit, so that they can never reach the eye of a spectator at the bottom of it.

But of all those who have given their attention to this subject of the reflection of light, none seems to have given such satisfaction as M. Bouguer; and next to those of Sir Isaac Newton, his labours seem to have been the most successful. The object of his curious and elaborate experiments was to measure the degrees of light, whether emitted, reflected, or refracted, by different bodies. They were originally occasioned by an article of M. Mairan's in the Memoirs of the French Academy for 1721, in which the proportion of the light of the sun at the two solstices was supposed to be known; and his laudable attempt to verify what had been before taken for granted, suggested a variety of new experiments, and opened to him and to the world a new field of optical knowledge. His first production upon this subject was a treatise entitled *Essai d'Optique*, which was received with general approbation. Afterwards, giving more attention to this subject, he formed an idea of a much larger work, to which many more experiments were necessary: but he was prevented, by a variety of interruptions, from executing his design so soon as he had proposed, and he had hardly completed it at the time of his death, in 1758; so that we are obliged to his friend M. de la Caille for the care of the publication. At length, however, it was printed at Paris in 1760, under the title of *Traité d'Optique*.

33 Discoveries of M. Bou-

At the entrance upon this treatise, we are induced to form the most pleasing expectations from our author's experiments, by his account of the variety, the singular accuracy, and circumspection, with which he made them; whereby he must, to all appearance, have guarded against every avenue to error, and particularly against those objections to which the few attempts that had been made, of a similar nature, before him had been liable. In order to compare different degrees of light, he always contrived to place the bodies from which it proceeded, or other bodies illuminated by them, in such a manner as that he could view them distinctly at the same time; and he either varied the stances of these bodies, or modified their light in some other way, till he could perceive no difference between them. Then, considering their different distances, or the other circumstances by which their light was affected, he calculated the proportion which they would have borne to each other at the same distance, or in the same circumstances.

To ascertain the quantity of light lost by reflection, he placed the mirror, or reflecting surface, B, on which the experiment was to be made, truly upright; and having taken two tablets, of precisely the same colour, or of an equal degree of whiteness, he placed them exactly parallel to one another at E and D, and threw light upon them by means of a lamp or candle, P, placed in a right line between them. He then placed himself so, that with his eye at A he could see the tablet E, and the image of the tablet D, reflected from the mirror B, at the same time; making them as it were, to touch one another. He then moved the candle along the line ED, so as to throw more or less light upon either of them, till he could perceive no difference in the strength of the light that came to his eye from either of them. After this, he had nothing more to do than to measure the distances EP and DP; for the squares of those distances expressed the degree in which the reflection of the mirror diminished the quantity of light. It is evident, that if the mirror reflected all the rays it received, the candle P must have been placed at C, at an equal distance from each of the tablets, in order to make them appear equally illuminated; but because much of the light is lost in reflection, they can only be made to appear equally bright by placing the candle nearer the tablet D, which is seen by reflexion only. Plate CCCLII. fig. 3.

To find how much light is lost by oblique reflection, he took two equally polished plates, D and E, and caused them to be enlightened by the candle P; and while one of them, D, was seen at A, by reflection from B, placed in a position oblique to the eye, the other, E, was so placed, as to appear contiguous to it; and removing the plate E, till the light which it reflected was no stronger than that which came from the image D, seen by reflection at B, he estimated the quantity of light that was lost by this oblique reflection, by the squares of the distances of the two objects from the candle. Fig. 4.

It need scarcely be added, that in these experiments all foreign light was excluded, that his eye was shaded, and that every other precaution was observed in order to make his conclusions unquestionable.

In order to ascertain the quantity of light lost by reflection with the greatest exactness, M. Bouguer introduced two beams of light into a darkened room, as by the apertures P and Q; which he had so contrived, that he could place them higher and lower, and enlarge or contract them at pleasure; and the reflecting surface (as that of a fluid contained in a vessel) was placed horizontally at O, from whence the light coming through the hole P, was reflected to R, upon the screen GH, where it was compared with another beam of light that fell upon S, through the hole Q; which he made so much less than P, as that the spaces S and R were equally illuminated; and by the proportion that the apertures P and Q bore to each other, he calculated what quantity of light was lost by the reflection at O. Fig. 5.

It was necessar , he observes, that the two beams of light

light PO and QS (which he uſually made 7 or 8 feet long) ſhould be exactly parallel, that they might come from two points of the ſky equally elevated above the horizon, and having preciſely the ſame intenſity of light. It was alſo neceſſary that the hole Q ſhould be a little higher than P, in order that the two images ſhould be at the ſame height, and near one another. It is no leſs neceſſary, he ſays, that the ſcreen GH be exactly vertical, in order that the direct and reflected beams may fall upon it, with the ſame inclination; ſince, otherwiſe, though the two lights were perfectly equal, they would not illuminate the ſcreen equally. This diſpoſition, he ſays, ſerves to anſwer another important condition in theſe experiments; for the direct ray QS muſt be of the ſame length with the ſum of the incident and reflected rays, PO and OR, in order that the quantity of light introduced into the room may be ſenſibly proportional to the ſizes of the apertures.

We ſhall now proceed to recite the reſult of the experiments which he made to meaſure the quantity of light that is loſt by reflection in a great variety of circumſtances; but we ſhall introduce them by the recital of ſome which were made previous to them on the diminution of light by reflection, and the tranſmiſſion of it to conſiderable diſtances through the air, by M. Buffon at the time that he was conſtructing his machine to burn at great diſtances, mentioned under the

34 article *Burning Glaſs*.

Of M. Buffon. Receiving the light of the ſun in a dark place, and comparing it with the ſame light of the ſun reflected by a mirror, he found that at ſmall diſtances, as four or five feet, about one half was loſt by reflection; as he judged by throwing two reflected beams upon the ſame place, and comparing them with a beam of direct light; for then the intenſity of them both ſeemed to be the ſame.

Having received the light at greater diſtances, as at 100, 200, and 300 feet, he could hardly perceive that it loſt any of its intenſity by being tranſmitted through ſuch a ſpace of air.

He afterwards made the ſame experiments with candles, in the following manner: He placed himſelf oppoſite to a looking glaſs, with a book in his hand, in a room perfectly dark; and having one candle lighted in the next room, at the diſtance of about 40 feet, he had it brought nearer to him by degrees, till he was juſt able to diſtinguiſh the letters of the book, which was then 24 feet from the candle. He then received the light of the candle, reflected by the looking glaſs, upon his book, carefully excluding all the light that was reflected from any thing elſe; and he found that the diſtance of the book from the candle, including the diſtance from the book to the looking glaſs (which was only half a foot) was in all 15 feet. He repeated the experiment ſeveral times, and always with nearly the ſame reſult; and therefore concluded, that the quantity of direct light is to that of reflected as 576 to 225; ſo that the light of five candles reflected from a plane mirror is about equal to that of two candles.

From theſe experiments it appeared, that more light was loſt by reflection of the candles than of the ſun, which M. Buffon thought was owing to this circumſtance that the light iſſuing from the candle diverges, and therefore falls more obliquely upon the mirror than the light of the ſun, the rays of which are nearly parallel.

Theſe experiments and obſervations of M. Buffon are curious; though it will be ſeen that they fall far ſhort of thoſe of M. Bouguer, both in extent and accuracy. We ſhall begin with thoſe which we made to aſcertain the difference in the quantity of light reflected by glaſs and poliſhed metal. 35

Uſing a ſmooth piece of glaſs one line in thickneſs, he found, that when it was placed at an angle of 15 degrees with the incident rays, it reflected 628 parts of 1000 which fell upon it; at the ſame time that a metallic mirror, which he tried in the ſame circumſtances, reflected only 561 of them. At a leſs angle of incidence much more light was reflected: ſo that at an angle of three degrees the glaſs reflected 700 parts, and the metal ſomething leſs, as in the former caſe. Mr Bouguer's diſcoveries concerning the reflection of glaſs and poliſhed metal.

Trying the reflection of bodies that were not poliſhed, he found that a piece of white plaſter, placed at an angle of 75°, with the incident rays, reflected $\frac{1}{2\frac{1}{2}}$ part of the light that is received from a candle nine inches from it. White paper, in the ſame circumſtances, reflected it in the ſame proportion; but at the diſtance of three inches, they both reflected 150 parts of 1000 that were incident.

Proceeding to make farther obſervations on the ſubject of reflected light, he premiſes the two following theorems, which he demonſtrates geometrically. 1. When the luminous body is at an infinite diſtance, and its light is received by a globe, the ſurface of which has a perfect poliſh, and abſorbs no light, it reflects the light equally in all directions, provided it be received at a conſiderable diſtance. He only excepts the place where the ſhadow of the globe falls; but this, he ſays, is no more than a ſingle point, with reſpect to the immenſity of the ſpherical ſurface which receives its light.

2. The quantity of light reflected in one certain direction will always be exactly the ſame, whether it be reflected by a very great number of ſmall poliſhed hemiſpheres, by a leſs number of larger hemiſpheres, or by a ſingle hemiſphere, provided they occupy the ſame baſe, or cover the ſame ground plan.

The uſe he propoſes to make of theſe theorems is to aſſiſt him in diſtinguiſhing whether the light reflected from bodies be owing to the extinction of it within them, or whether the roughneſs or eminences which cover them have not the ſame effect with the ſmall poliſhed hemiſpheres above mentioned.

He begins with obſerving, that, of the light reflected from Mercury, ¼ at leaſt is loſt, and that probably no ſubſtances reflect more than this. The rays were received at an angle of 11½ degrees of incidence, that is meaſured from the ſurface of the reflecting body, and not from the perpendicular, which, he ſays, is what we are from this place to underſtand whenever he mentions the angle of incidence. 36

The moſt ſtriking obſervations which he made with reſpect to this ſubject, are thoſe which relate to the very great difference in the quantity of light reflected at different angles of incidence. In general, he ſays, that reflection is ſtronger at ſmall angles of incidence, and weaker at large ones. The difference is exceſſive when the rays ſtrike the ſurface of tranſparent ſubſtances, Great difference in the reflective power of ſubſtances according to the angle of incidence.

ſtances, with different degrees of obliquity; but it is almoſt as great in ſome opaque ſubſtances, and it was always more or leſs ſo in every thing that he tried. He found the greateſt inequality in black marble; in which he was aſtoniſhed to find, that with an angle of 3° 35′ of incidence, though not perfectly poliſhed, yet it reflected almoſt as well as quickſilver. Of 1000 rays which it received, it returned 600; but when the angle of incidence was 14 degrees, it reflected only 156: when it was 30, it reflected 51; and when it was 80, it reflected only 23.

Similar experiments made with metallic mirrors always gave the differences much leſs conſiderable. The greateſt was hardly ever an eighth or a ninth part of it, but they were always in the ſame way.

The great difference between the quantity of light reflected from the ſurface of water, at different angles of incidence, is truly ſurpriſing; but our author obſerves, that this difference was greater when the ſmalleſt inclinations were compared with thoſe which were near to a right angle. He ſometimes ſuſpected, that, at very ſmall angles of incidence, the reflection from water was even greater than from quickſilver. All things conſidered, he thought it was not quite ſo great, though it was very difficult to determine the preciſe difference between them. In very ſmall angles, he ſays, that water reflects nearly ¾ of the direct light.

There is no perſon, he ſays, but has ſometimes felt the force of this ſtrong reflection from water, when he has been walking in ſtill weather on the brink of a lake oppoſite to the ſun. In this caſe, the reflected light is ⅓, ½, or ſometimes a greater proportion of the light that comes directly from the ſun, which is an addition to the direct rays of the ſun that cannot fail to be very ſenſible. The direct light of the ſun diminiſhes gradually as it approaches the horizon, while the reflected light at the ſame time grows ſtronger: ſo that there is a certain elevation of the ſun, in which the united force of the direct and reflected light will be the greateſt poſſible, and this he ſays is 12 or 15 degrees.

On the other hand, the light reflected from water at great angles of incidence is extremely ſmall. Our author was aſſured, that, when the light was perpendicular, it reflected no more than the 37th part that quickſilver does in the ſame circumſtances; for it did not appear, from all his obſervations, that water reflects more than the 60th, or rather the 55th, part of perpendicular light. When the angle of incidence was 50 degrees, the light reflected from the ſurface of water was about the 32d part of that which mercury reflected; and as the reflection from water increaſes with the diminution of the angle of incidence, it was twice as ſtrong in proportion at 39 degrees; for it was then the 16th part of the quantity that mercury reflected.

In order to procure a common ſtandard by which to meaſure the proportion of light reflected from various fluid ſubſtances, he pitched upon water as the moſt commodious; and partly by obſervation, and partly by calculation, which he always found to agree with his obſervations, he drew up the following table of the quantity of light reflected from the ſurface of water, at different angles with the ſurface.

| Angles of incidence. | Rays reflected of 1000. | Angles of incidence. | Rays reflected of 1000. |
|---|---|---|---|
| ½ | 721 | 17 ½ | 178 |
| 1 | 692 | 20 | 145 |
| 1 ½ | 669 | 25 | 97 |
| 2 | 639 | 30 | 65 |
| 2 ½ | 614 | 40 | 34 |
| 5 | 501 | 50 | 22 |
| 7 ½ | 409 | 60 | 19 |
| 10 | 333 | 70 | 18 |
| 12 ½ | 271 | 80 | 18 |
| 15 | 211 | 90 | 18 |

In the ſame manner, he drew up the following table of the quantity of light reflected from the looking glaſs not quickſilvered.

| Angles of incidence. | Rays reflected of 1000. | incidence | flected of 1000. |
|---|---|---|---|
| 2 ½ | 584 | 30 | 112 |
| 5 | 543 | 40 | 57 |
| 7 ½ | 474 | 50 | 34 |
| 10 | 412 | 60 | 27 |
| 12 ½ | 356 | 70 | 25 |
| 15 | 299 | 80 | 25 |
| 20 | 222 | 90 | 25 |
| 25 | 157 | | |

Pouring a quantity of water into a veſſel containing quickſilver, it is evident that there will be two images of any object ſeen by reflection from them, one at the ſurface of the water, and the other at that of the quickſilver. In the largeſt angles of incidence, the image at the ſurface of the water will diſappear, which will happen when it is about a 60th or an 80th part leſs luminous than the image at the ſurface of the quickſilver. Depreſſing the eye, the image on the water will grow ſtronger, and that on the quickſilver weaker in proportion; till at laſt, the latter will be incomparably weaker than the former, and at an angle of about 10 degrees they will be equally luminous. According to the table, $\frac{333}{1000}$ of the incident rays are reflected from the water at this angle of 10 degrees. At the ſurface of the mercury they were reduced to 500; and of theſe, part being reflected back upon it from the under ſurface of the water, only 333 remained to make the image from the mercury.

It has been obſerved by ſeveral perſons, particularly by Mr Edwards, (ſee Phil. Tranſ. Vol. LIII. p. 229.) that there is a remarkably ſtrong reflection into water, with reſpect to rays iſſuing from the water; and perſons under water have ſeen images of things in the air in a manner peculiarly diſtinct and beautiful: but this fact had not been obſerved with a ſufficient degree of attention, till it came into M. Bouguer's way to do it, and he acknowledges it to be very remarkable. In this caſe, he ſays, that from the ſmalleſt angles of incidence, to a certain number of degrees, the greateſt part of the rays are reflected, perhaps in as great a proportion as at the ſurface of metallic mirrors, or of quickſilver; while the other part, which does

37 Reflection of images by the air.

does not escape into the air, is extinguished or absorbed; so that the surface of the transparent body appears opaque on the inside. If the angle of incidence be increased only a few degrees, the strong reflection ceases altogether, a great number of rays escape into the air, and very few are absorbed or extinguished. In proportion as the angle of incidence is farther increased, the quantity of the light reflected becomes less and less; and when it is near 90 degrees, almost all the rays escape out of the transparent body, its surface losing almost all its power of reflection, and becoming almost as transparent as it is in other cases, or when the light falls upon it from without.

38 Extinction of the rays of light at the surface of transparent bodies.

This property belonging to the surfaces of transparent bodies, of absorbing or extinguishing the rays of light, is truly remarkable, and, as there is reason to believe, had not been noticed by any person before M. Bouguer. It had been conjectured by Sir Isaac Newton that rays of light become extinct only by impinging upon the solid parts of bodies; but these observations of M. Bouguer show that the fact is quite otherwise; and that this effect is to be attributed, not to the solid parts of bodies, which are certainly more numerous in a long tract of water than just in the passage out of water into air, but to some power lodged at the surfaces of bodies only, and therefore probably the same with that which reflects, refracts, and inflects the light.

39 Strong reflection by a prism.

One of the above-mentioned observations, viz. all the light being reflected at certain angles of incidence from air into denser substances, had frequently been made, especially in glass prisms; so that Newton made use of one of them, instead of a reflecting mirror, in the construction of his telescope. If a beam of light fall upon the air from within these prisms, at an angle of 10, 20, or 30 degrees, the effect will be nearly the same as at the surface of quicksilver, a fourth or a third of the rays being extinguished, and $\frac{2}{3}$ or $\frac{3}{4}$ths reflected. This property retains its full force as far as an incidence of 49° 49′, (supposing the proportion of the sines of the refraction to be 31 and 20 for the mean refrangible rays); but if the angle of incidence be increased but one degree, the quantity of light reflected inwards decreases suddenly, and a great part of the rays escape out of the glass, so that the surface becomes suddenly transparent.

All transparent bodies have the same property, with this difference, that the angle of incidence at which the strong reflection ceases, and at which the light which is not reflected is extinguished, is greater in some than in others. In water this angle is about 41° 32′; and in every medium it depends so much on the invariable proportion of the sine of the angle of refraction to the sine of the angle of incidence, that this law alone is sufficient to determine all the phenomena of this new circumstance, at least as to this accidental opacity of the surface.

When our author proceeded to measure the quantity of light reflected by these internal surfaces at great angles of incidence, he found many difficulties, especially on account of the many alterations which the light underwent before it came to his eye: but at length, using a plate of crystal, he found, that, at an angle of 75 degrees, this internal reflection diminished the light 27 or 28 times; and as the external reflection at the same angle diminished the light only 26 times, it follows that the internal reflection is a little stronger than the other.

Repeating these experiments with the same and different pieces of crystal, he sometimes found the two reflections to be equally strong; but, in general, the internal was the stronger. Also, the image reflected internally was always a little redder than an object which was seen directly through the plate of crystal.

Resuming his observations on the diminution of the light, occasioned by the reflection of opaque bodies obliquely situated, he compared it with the appearances of similar substances which reflected the light perpendicularly. Using pieces of silver made very white, he found, that, when one of them was placed at an angle of 75 degrees with respect to the light, it reflected only 640 parts out of 1000. He then varied the angle, and also used white plaster and fine Dutch paper, and drew up the following table of the proportion of the light reflected from each of those substances at certain angles.

40 Of the quantity of light reflected by different substances.

Quantity of Light reflected from

| Angles of incidence. | Silver. | Plaster. | Dutch Paper. |
|---|---|---|---|
| 90 | 1000 | 1000 | 1000 |
| 75 | 802 | 762 | 971 |
| 60 | 640 | 640 | 743 |
| 45 | 455 | 529 | 507 |
| 30 | 319 | 352 | 332 |
| 15 | 209 | 194 | 203 |

Supposing the asperities of opaque bodies to consist of very small planes, it appears from these observations, that there are fewer of them in those bodies which reflect the light at small angles of incidence than at greater; and our author says, that the case was nearly the same with respect to all the opaque bodies that he tried. None of them had their roughness equivalent to small hemispheres, which would have dispersed the light equally in all directions; and, from the *data* in the preceding table, he deduces mathematically the number of the little planes that compose those surfaces, and that are inclined to the general surface at the angles above-mentioned, supposing that the whole surface contains 1000 of them that are parallel to itself, so as to reflect the light perpendicularly, when the luminous body is situated at right angles with respect to it. His conclusions reduced to a table, corresponding to the preceding, are as follow:

| Inclinations of the small surfaces with respect to the large one. | The distribution of the small planes that constitute the asperities of the opaque surface in the Silver. | Plaster. | Paper. |
|---|---|---|---|
| 0 | 1000 | 1000 | 1000 |
| 15 | 777 | 736 | 937 |
| 30 | 554 | 554 | 545 |
| 45 | 333 | 374 | 358 |
| 60 | 161 | 176 | 166 |
| 75 | 53 | 50 | 52 |

These

These variations in the number of little planes, or surfaces, he expresses in the form of a curve; and afterwards he shows, geometrically, what would be the effect if the bodies were enlightened in one direction, and viewed in another; upon which subject he has several curious theorems and problems: as, the position of the eye being given, to find the angle at which the luminous body must be placed, in order to its reflecting the most light; or, the situation of the luminous body being given, to find a proper situation for the eye, in order to see the most enlightened, &c. But it would carry us too far into geometry to follow him through all these disquisitions.

41 Observations concerning the planets, &c.

Since the planets, as the accurate observer takes notice, are more luminous at their edges than at their centres, he concludes, from the above-mentioned principles, that the bodies which form them are constituted in a manner different from ours; particularly that their opaque surfaces consist of small planes, more of which are inclined to the general surface than they are in terrestrial substances; and that there are in them an infinity of points, which have exactly the same splendour.

Our philosopher and geometrician next proceeds to ascertain the quantity of surface occupied by the small planes of each particular inclination, from considering the quantity of light reflected by each, allowing those that have a greater inclination to the common surface to take up proportionably less space than those which are parallel to it. And comparing the quantity of light that would be reflected by small planes thus disposed, with the quantity of light that was actually reflected by the three substances above-mentioned, he found that plaster, notwithstanding its extreme whiteness, absorbs much light; for that, of 1000 rays that fall upon it, of which 166 or 167 ought to be reflected at an angle of 77 degrees, only 67 are in fact returned; so that 100 out of 167 were extinguished, that is, about three-fifths.

With respect to the planets, our author concludes, that of 300,000 rays which the moon receives, 172,000 are absorbed, or perhaps 204,100.

42 Of the surfaces of bodies.

Having considered the surfaces of bodies as consisting of planes only, he thus explains himself.—Each small surface, separately taken, is extremely irregular, and some of them are really concave, and others convex; but, in reducing them to a middle state, they are to be considered as planes. Nevertheless he considers them as planes only with respect to the reception of the rays; for as they are almost all curves, and as, besides this, many of those whose situation is different from others contribute to the same effect, the rays always issue from an actual or imaginary focus, and after reflection always diverge from another.

If it be asked, what becomes of those rays that are reflected from one asperity to another? he shows that very few of the rays can be in those circumstances; since they must fall upon planes which have more than 45 degrees of obliquity to the surface, of which there are very few in natural bodies. These rays must also fall at the bottom of those planes, and must meet with other planes similarly situated to receive them; and considering the great irregularity of the surfaces of opaque bodies, it may be concluded that very few of the rays are thus reflected upon the body itself; and that the little that is so reflected is probably lost to the spectators, being extinguished in the body.

43 Mr Melville's observations on the manner in which bodies are heated by light.

We are obliged to Mr Melville for some ingenious observations on the manner in which bodies are heated by light. He observes, that, as each colorific particle of an opaque body must be somewhat moved by the reflection of the particles of light, when it is reflected backwards and forwards between the same particles, it is manifest that they must likewise be agitated with a vibratory motion, and the time of a vibration will be equal to that which light takes up in moving from one particle of a body to another adjoining. This distance, in the most solid opaque bodies, cannot be supposed greater than $\frac{1}{12500}$th of an inch, which space a particle of light describes in the $\frac{1}{125000000000000}$th of a second. With so rapid a motion, therefore, may the internal parts of bodies be agitated by the influence of light, as to perform 125,000,000,000,000 vibrations, or more, in a second of time.

The arrival of different particles of light at the surface of the same colorific particle, in the same or different rays, may disturb the regularity of its vibrations, but will evidently increase their frequency, or raise still smaller vibrations among the parts which compose those particles; by which means the intestine motion will become more subtle, and more thoroughly diffused. If the quantity of light admitted into the body be increased, the vibrations of the particles must likewise increase in magnitude and velocity, till at last they may be so violent, as to make all the component particles dash one another to pieces by their mutual collision; in which case, the colour and texture of the body must be destroyed.

Since there is no reflection of light but at the surface of a medium, the same person observes, that the greatest quantity of rays, though crowded into the smallest space, will not of themselves produce any heat. From hence it follows, that the portion of air which lies in the focus of the most potent speculum, is not at all affected by the passage of light through it, but continues of the same temperature with the ambient air; though any opaque body, or even any transparent body denser than air, when put in the same place, would be intensely heated in an instant.

This consequence, evidently flowing from the plainest and most certain principles, not seeming to have been rightly understood by many philosophers, and even the silence of most physical writers concerning this paradoxical truth making it probable that they were unacquainted with it, he thought it worth his while to say something in explication of it. He observes, that the easiest way to be satisfied of the matter experimentally is, to hold a hair, or a piece of down, immediately above the focus of a lens or speculum, or to blow a stream of smoke from a pipe horizontally over it; for if the air in the focus were hotter than the surrounding fluid, it would continually ascend upon account of its rarefaction, and thereby sensibly agitate those slender bodies. Or a lens may be so placed as to form its focus within a body of water, or some other transparent substance, the heat of which may be examined from time to time with a thermometer; but care must be taken, in this experiment, to hold the lens as near as possible to the transparent body, lest the rays, by falling closer than ordinary on its surface,

surface, should warm it more than the common sunbeams (B).

To apply these observations to the explication of natural phenomena, he observes, that the atmosphere is not much warmed by the passage of the sun's light through it, but chiefly by its contact with the heated surface of the globe. This, he thought, furnished one very simple and plausible reason why it is coldest in all climates on the tops of very high mountains; namely, because they are removed to the greatest distance from the general surface of the earth. For it is well known, that a fluid heated by its contact with a solid body, decreases in heat in some inverse proportion to the distance from the body. He himself found, by repeated trials, that the heat of water in deep lakes decreases regularly from the surface downwards. But to have this question fully determined, the temperature of the air in the valley and on the mountain top must be observed every hour, both night and day, and carefully compared together.

From this doctrine he thinks it reasonable to suppose, that the heat produced by a given number of rays, in an opaque body of a given magnitude, must be greater when the rays are more inclined to one another, than when they are less so; for the direction of the vibrations raised by the action of the light, whether in the colorific particles, or those of an inferior order, will more interfere with one another; from whence the intestine shocks and collisions must increase. Besides this, the colorific particles of opaque bodies being disposed in various situations, perhaps, upon the whole, the rays will fall more directly on each, the more they are inclined to one another. Is not this, says he, the reason of what has been remarked by philosophers, that the heat of the sun's light, collected into a cone, increases in approaching the focus in a much higher proportion than according to its density? That the difference of the angle in which the rays fall on any particle of a given magnitude, placed at different distances from the focus, is but small, is no proof that the phenomenon cannot be ascribed to it; since we know not in what high proportion one or both the circumstances now mentioned may operate. However, that it proceeds not from any unknown action of the rays upon one another, as has been insinuated, is evident from this, that each particular ray, after passing through the focus, preserves its own colour and its own direction, in the same manner as if it were alone.

44 Abbé Nollet's experiments with burning glasses.

The attempts of the Abbé Nollet to fire inflammable substances by the power of the solar rays collected in the foci of burning mirrors, have a near relation to the present subject. Considering the great power of burning mirrors and lenses, especially those of late construction, it will appear surprising that this celebrated experimental philosopher should not be able to fire any liquid substance. But though he made the trial with all the care imaginable on the 19th of February 1757, he was not able to do it either with spirit of wine, olive oil, oil of turpentine, or ether; and though he could fire sulphur, yet he could not succeed with Spanish wax, rosin, black pitch, or suet. He both threw the focus of these mirrors upon the substances themselves, and also upon the fumes that rose from them; but all the effect was, that the liquor boiled, and was dispersed in vapour or very small drops, but would not take fire. When linen rags, and other solid substances, were moistened with any of these inflammable liquids, they would not take fire till the liquid was dispersed in a copious fume; so that rags thus prepared were longer in burning than those that were dry.

45 M. Beaume's experiments.

M. Beaume, who assisted M. Nollet in some of these experiments, observed farther, that the same substances which were easily fired by the flame of burning bodies, could not be set on fire by the contact of the hottest bodies that did not actually flame. Neither ether nor spirit of wine could be fired with a hot coal, or even red hot iron, unless they were of a white heat. From these experiments our author concludes, that, supposing the electric matter to be the same thing with fire or light, it must fire spirit of wine by means of some other principle. The members of the academy Del Cimento had attempted to fire several of these substances, though without success; but this was so early in the history of philosophy, that nobody seems to have concluded, that, because they failed in this attempt, the thing could not be done. However, the Abbé informs us, that he read an account of his experiments to the Royal Academy at Paris several years before he attended to what had been done by the Italian philosophers.

46 Bodies which seem to touch one another are not in actual contact.

By the help of optical principles, and especially by observations on the reflection of light, Mr Melville discovered that bodies which seem to touch one another are not always in actual contact. "It is common (says he) to admire the volubility and lustre of drops of rain that lie on the leaves of colewort, and some other vegetables;" but no philosopher, as far as he knew, had put himself to the trouble of explaining this curious phenomenon. Upon inspecting them narrowly, he found that the lustre of the drop is produced by a copious reflection of light from the flattened part of its surface contiguous to the plant. He observed farther, that, when the drop rolls along a part which has been wetted, it immediately loses all its lustre, the green plant being then seen clearly through it; whereas, in the other case, it is hardly to be discerned.

From these two observations put together, he concluded, that the drop does not really touch the plant, when it has the mercurial appearance, but is suspended in the air at some distance from it by the force of a repulsive power. For there could not be any copious reflection of white light from its under surface, unless there were a real interval between it and the surface of the plant.

If that surface were perfectly smooth, the under surface of the drop would be so likewise, and would therefore show an image of the illuminating body by reflection

(B) To these observations objections might be made, which it would not perhaps be easy to answer; but we are at present giving only the *history* of optics.

reflection, like a piece of polished silver; but as it is considerably rough and unequal, the under surface becomes rough likewise, and so, by reflecting the light copiously in different directions, assumes the resplendent white colour of unpolished silver.

It being thus proved by an optical argument, that the drop is not really in contact with the plant which supports it, it may easily be conceived whence its volubility arises, and why it leaves no moisture where it rolls.

47
Two curious miscellaneous observations.

Before we conclude the history of the observations concerning the reflection of light, we must not omit to take notice of two curious miscellaneous ones. Baron Alexander Funk, visiting some silver mines in Sweden, observed, that, in a clear day, it was as dark as pitch underground, in the eye of a pit, at 60 or 70 fathoms deep; whereas, in a cloudy or rainy day, he could even see to read at 106 fathoms deep. Inquiring of the miners, he was informed that this is always the case; and, reflecting upon it, he imagined that it arose from this circumstance, that when the atmosphere is full of clouds, light is reflected from them into the pit in all directions, and that thereby a considerable proportion of the rays are reflected perpendicularly upon the earth; whereas, when the atmosphere is clear, there are no opaque bodies to reflect the light in this manner, at least in a sufficient quantity; and rays from the sun itself can never fall perpendicularly in that country. The other was that of the ingenious Mr Grey, who makes such a figure in the history of electricity. This gentleman took a piece of stiff brown paper, and pricking a small hole in it, he held it at a little distance before him; when, applying a needle to his eye, he was surprised to see the point of it inverted. The nearer the needle was to the hole, the more it was magnified, but the less distinct; and if it was so held, as that its image was near the edge of the hole, its point seemed crooked. From these appearances he concluded, that these small holes, or something in them, produce the effects of concave speculums; and from this circumstance he took the liberty to call them *aërial speculums*.

### § 4. *Discoveries concerning the Inflection of Light.*

This property of light was not discovered till about the middle of the last century. The person who first made the discovery was Father Grimaldi; at least he first published an account of it in his treatise *De lumine, coloribus, et iride*, printed in 1666. Dr Hooke, however, laid claim to the same discovery, though he did not publish his observations till six years after Grimaldi; having probably never seen his performance.

48
Dr Hooke's discoveries.

Dr Hooke having made his room completely dark, admitted into it a beam of the sun's light by a very small hole in a brass plate fixed in the window-shutter. This beam spreading itself, formed a cone, the apex of which was in the hole, and the base was on a paper, so placed as to receive it at some distance. In this image of the sun, thus painted on the paper, he observed that the middle was much brighter than the edges, and that there was a kind of dark penumbra about it, of about a 16th part of the diameter of the circle; which penumbra, he says, must be ascribed to a property of light, which he promised to explain.— Having observed this, at the distance of about two inches from the former he let in another cone of light; and receiving the bases of them, at such a distance from the holes as that the circles intersected each other, he observed that there was not only a penumbra, or darker ring, encompassing the lighter circle, but a manifest dark line, or circle, which appeared even where the limb of the one interfered with that of the other. This appearance is distinctly represented, fig. 6. Plate CCCLII.

Comparing the diameter of this base with its distance from the hole, he found it to be by no means the same as it would have been if it had been formed by straight lines drawn from the extremities of the sun's disk, but varied with the size of the holes, and the distance of the paper.

Struck with this appearance, he proceeded to make farther experiments concerning the nature of light thus transmitted. To give a just idea of which he held an opaque body BB, fig. 7. so as to intercept the light that entered at a hole in the window shutter O, and was received on the screen AP. In these circumstances, he observed, that the shadow of the opaque body (which was a round piece of wood, not bright or polished) was all over somewhat enlightened, but more especially towards the edge. Some persons who were present, imagining that this light within the shadow might be produced by some kind of reflection from the side of this opaque body, on account of its roundness; and others supposing it might proceed from some reflection from the sides of the hole in the piece of brass through which the light was admitted into the room; to obviate both these objections, he admitted the light through a hole burnt in a piece of pasteboard, and intercepted it with a razor which had a very sharp edge; but still the appearances were the very same as before: so that, upon the whole, he concluded that they were occasioned by a new property of light, different from any that had been observed by preceding writers.

He farther diversified this experiment, by placing the razor so as to divide the cone of light into two parts, the hole in the shutter remaining as before, and placing the paper so as that none of the enlightened part of the circle fell upon it, but only the shadow of the razor; and, to his great surprise, he observed what he calls a *very brisk and visible radiation* striking down upon the paper, of the same breadth with the diameter of the lucid circle; and this radiation always struck perpendicularly from the line of shadow, and, like the tail of a comet, extended more than 10 times, and probably more than 100 times the breadth of the remaining part of the circle: nay, as far as he could find, by many trials, the light from the edge struck downwards into the shadow very near to a quadrant, though the greater were the deflections of this new light from the direct radiations of the cone, the more faint they were.

Observing this appearance with more attention, he found, wherever there was a part of the interposed body higher than the rest, that, opposite to it, the radiation of light into the shadow was brighter, as in the figure; and wherever there was a notch or gap in it, there would be a dark stroke in the half-enlightened shadow. From all these appearances, he concluded, that they were

were to be aſcribed to a new property of light, whereby it is deflected from ſtraight lines, contrary to what had been before aſſerted by optical writers.

It does not appear, however, that our philoſopher ever proſecuted this experiment to any purpoſe; as all that we find of his on the ſubject of light, after this time, are ſome crude thoughts which he read at a meeting of the Royal Society, on the 18th of March 1675; which, however, as they are only ſhort hints, we ſhall copy.

They conſiſt of eight articles; and, as he thought, contained an account of ſeveral properties of light that had not been noticed before. There is a deflection of light, differing both from reflection and refraction, and ſeeming to depend on the unequal denſity of the conſtituent parts of the ray, whereby the light is diſperſed from the place of condenſation, and rarefied, or gradually diverged into a quadrant. 2. This deflection is made towards the ſuperficies of the opaque body perpendicularly. 3. Thoſe parts of the diverged radiations which are deflected by the greateſt angle from the ſtraight or direct radiations are the fainteſt, and thoſe that are deflected by the leaſt angles are the ſtrongeſt. 4. Rays cutting each other in one common foramen do not make the angles at the vertex equal. 5. Colours may be made without refraction. 6. The diameter of the ſun cannot be truly taken with common ſights. 7. The ſame rays of light, falling upon the ſame point of an object, will turn into all ſorts of colours, by the various inclinations of the object. 8. Colours begin to appear when two pulſes of light are blended ſo well, and ſo near together, that the ſenſe takes them for one.

49 Grimaldi's diſcoveries. Plate CCCLII.

We ſhall now proceed to the diſcoveries of Father Grimaldi. Having introduced a ray of light, through a very ſmall hole, AB, fig. 8. into a darkened room, he obſerved that the light was diffuſed in the form of a cone, the baſe of which was CD; and that if any opaque body, FE, was placed in this cone of light, at a conſiderable diſtance from the hole, and the ſhadow was received upon a piece of white paper, the boundaries of it were not confined within GH, or the penumbra IL, occaſioned by the light proceeding from different parts of the aperture, and of the diſk of the ſun, but extended to MN; at which he was very much ſurpriſed, ſuſpecting, and finding by calculation, that it was conſiderably broader than it could have been made by rays paſſing in right lines by the edges of the object.

But the moſt remarkable circumſtance in this appearance was, that upon the lucid part of the baſe, CM and ND, ſtreaks of coloured light were plainly diſtinguiſhed, each being terminated by blue on the ſide next to the ſhadow, and by red on the other; and though theſe coloured ſtreaks depended, in ſome meaſure, on the ſize of the aperture AB, becauſe they could not be made to appear if it was large, yet he found that they were not limited either by it, or by the diameter of the ſun's diſk.

He farther obſerved, that theſe coloured ſtreaks were not all of the ſame breadth, but grew narrower as they receded from the ſhadow, and were each of them broader the farther the ſhadow was received from the opaque body, and alſo the more obliquely the paper on which they were received was held with reſpect to it. He never obſerved more than three of theſe ſtreaks.

To give a clearer idea of theſe coloured ſtreaks, he drew the repreſentation of them, exhibited in fig. 9. in which NMO repreſents the broadeſt and moſt luminous ſtreak, next to the dark ſhadow X. In the ſpace in which M is placed there was no diſtinction of colour, but the ſpace NN was blue, and the ſpace OO, on the other ſide of it, was red. The ſecond ſtreak, QPR was narrower than the former; and of the three parts of which it conſiſted, the ſpace P had no particular colour, but QQ was a faint blue, and RR a faint red. The third ſtreak, TSV, was exactly ſimilar to the two others, but narrower than either of them, and the colour ſtill fainter.

Theſe coloured ſtreaks he obſerved to lie parallel to the ſhadow of the opaque body; but when it was of an angular form, they did not make the ſame acute angles, but were bent into a curve, the outermoſt being rounder than thoſe that were next the ſhadow, as is repreſented in fig. 10. If it was an inward angle, as DCH, the coloured ſtreaks, parallel to each other of the two ſides croſſed without obliterating one another; only the colours were thereby rendered either more intenſe or mixed.

The light that formed theſe coloured ſtreaks, the reader will perceive, muſt have been bent from the body; but this attentive obſerver has likewiſe given an account of other appearances, which muſt have been produced by the light bending towards the body. For within the ſhadow itſelf he ſometimes perceived coloured ſtreaks, ſimilar to thoſe above mentioned on the outſide of the ſhadow. Sometimes he ſaw more of them, and ſometimes fewer; but for this purpoſe a very ſtrong light was requiſite, and the opaque body was obliged to be long, and of a moderate breadth; which, he ſays, is eaſily found by experience. A hair, for inſtance, or a fine needle, did not anſwer ſo well as a thin and narrow plate: and the ſtreaks were moſt diſtinguiſhable when the ſhadow was taken at the greateſt diſtance; but then the light grew fainter in the ſame proportion.

The number of theſe ſtreaks within the ſhadow was greater in proportion to the breadth of the plate. They were at leaſt two, and ſometimes four, if a thicker rod were made uſe of. But, with the ſame plate or rod, more or fewer ſtreaks appeared, in proportion to the diſtance at which the ſhadow was received; but they were broader when they were few, and narrower when there were more of them; and they were all much more diſtinct when the paper was held obliquely.

Theſe coloured ſtreaks within the ſhadow, like thoſe on the outſide of it, were bent in an arch, round the acute angles of the ſhadow, as they are repreſented in fig. 11. At this angle alſo, as at D, other ſhorter lucid ſtreaks were viſible, bent in the form of a plume, as they are drawn betwixt D and C, each bending round and meeting again in D. Theſe angular ſtreaks appeared, though the plate or rod was not wholly immerſed in the beam of light, but the angle of it only; and there were more or fewer in number in proportion to the breadth of the rod or plate. If the plate

or

or rod was very thin, the coloured ſtreaks within the ſhadow might be ſeen to bend round from the oppoſite ſides, and meet one another as at B. A only repreſents a ſection of the figure, and not a proper termination of the ſhadow, and the ſtreaks within each ſide of it. The coloured ſtreaks without the ſhadow, he alſo obſerves, bend round it in the ſame manner.

Our author acknowledges, that he omits ſeveral obſervations of leſs conſequence, which cannot but occur to any perſon who ſhall make the experiment: and he ſays, that he was not able to give a perfectly clear idea of what he has attempted to deſcribe, nor does he think it in the power of words to do it.

In order to obtain the more ſatisfactory proof that rays of light do not always proceed in ſtraight lines, but really bend, in paſſing by the edges of bodies, he diverſified the firſt of the above-mentioned experiments in the following manner. He admitted a beam of light, by a very ſmall aperture, into a darkened room, as before; and, at a great diſtance from it, he

Plate CCCLII.

fixed a plate EF, fig. 12. with a ſmall aperture, GH, which admitted only a part of the beam of light, and found, that when the light tranſmitted through this plate was received at ſome diſtance upon a white paper, the baſe IK was conſiderably larger than it could poſſibly have been made by rays iſſuing in right lines through the two apertures, as the other ſtraight lines drawn cloſe to their edges plainly demonſtrate.

That thoſe who chooſe to repeat theſe experiments may not be diſappointed in their expectations from them, our author gives the following more particular inſtructions. The ſun's light muſt be very intenſe, and the apertures through which it is tranſmitted very narrow, particularly the firſt, CD, and the white paper, IK, on which it is received, muſt be at a conſiderable diſtance from the hole GH; otherwiſe it will not much exceed NO, which would be the breadth of the beam of light proceeding in ſtraight lines. He generally made the aperture CD $\frac{4}{100}$ or $\frac{5}{100}$ part of an ancient Roman foot, and the ſecond aperture, GH, $\frac{2}{100}$ or $\frac{3}{100}$; and the diſtances DG and GN, were, at leaſt, 12 ſuch feet. The obſervation was made in the ſummer time, when the atmoſphere was free from all vapours, and about mid-day.

F. Grimaldi alſo made the ſame experiment that has been recited from Dr Hooke, in which two beams of light, entering a darkened room by two ſmall apertures near to one another, projected cones of light, which, at a certain diſtance, in part coincided; and he particularly obſerved that the dark boundaries of each of them were viſible within the lucid ground of the other.

50
Obſervation of Dechales.

To theſe diſcoveries of Grimaldi, we ſhall ſubjoin an additional obſervation of Dechales; who took notice, that if ſmall ſcratches be made in any piece of poliſhed metal, and it be expoſed to the beams of the ſun in a darkened room, it will reflect the rays ſtreaked with colours in the direction of the ſcratches; as will appear if the reflected light be received upon a piece of white paper. That theſe colours are not produced by refraction, he ſays, is manifeſt; for that, if the ſcratches be made upon glaſs, the effect will be the ſame; and in this caſe, if the light had been refracted at the ſurface of the glaſs, it would have been tranſmitted through it. From theſe, and many other obſervations, he concludes that colour does not depend upon the refraction of light only, nor upon a variety of other circumſtances, which he particularly enumerates, and the effects of which he diſcuſſes, but upon the intenſity of the light only.

We ſhall here give an account of a phenomenon of viſion obſerved by M. de la Hire, becauſe the ſubject of this ſection, viz. the *inflection of light*, ſeems to ſupply the true ſolution of it, though the author himſelf thought otherwiſe. It is obſervable, he ſays, that when we look at a candle, or any luminous body, with our eyes nearly ſhut, rays of light are extended from it, in ſeveral directions, to a conſiderable diſtance, like the tails of comets. This appearance exerciſed the ſagacity of Deſcartes and Rohault, as well as of our author; but all three ſeem to have been miſtaken with reſpect to it. Deſcartes aſcribed this effect to certain wrinkles in the ſurface of the humours of the eye. Rohault ſays, that when the eye-lids are nearly cloſed, the edges of them act like convex lenſes. But our author ſays, that the moiſture on the ſurface of the eye, adhering partly to the eye itſelf, and partly to the edge of the eye-lid, makes a concave mirror, and ſo diſperſes the rays at their entrance into the eye. But the true reaſon ſeems to be, that the light paſſing among the eye-laſhes, in this ſituation of the eye, is inflected by its near approach to them, and therefore enters the eye in a great variety of directions. The two former of theſe opinions are particularly ſtated and objected to by our author. 51 Of M. de la Hire.

The experiments of Father Grimaldi and Dr Hooke were not only repeated with the greateſt care by Sir Iſaac Newton, but carried much farther than they had thought of. So little uſe had been made of Grimaldi's obſervation, that all philoſophers before Newton had aſcribed the broad ſhadows, and even the fringes of light which he deſcribed, to the ordinary refraction of the air: but we ſhall ſee them placed in a very different point of view by our author. 52 Sir Iſaac Newton's diſcoveries.

He made in a piece of lead a ſmall hole with a pin, the breadth of which was the 42d part of an inch. Through this hole he let into his darkened chamber a beam of the ſun's light; and found, that the ſhadows of hairs, and other ſlender ſubſtances placed in it, were conſiderably broader than they would have been if the rays of light had paſſed by thoſe bodies in right lines. He therefore concluded, that they muſt have paſſed as they are repreſented in fig. 1. in which X repreſents a ſection of the hair, and AD, BE, &c. rays of light paſſing by at different diſtances, and then falling upon the wall GQ. Since, when the paper which receives the rays is at a great diſtance from the hair, the ſhadow is broad, it muſt follow, as he obſerves, that the hair acts upon the rays of light at ſome conſiderable diſtance from it, the action being ſtrongeſt on thoſe rays which are at the leaſt diſtance, and growing weaker and weaker on thoſe which are farther off, as is repreſented in this figure; and from hence it comes to paſs that the ſhadow of the hair is much broader in proportion to the diſtance of the paper from the hair when it is nearer than when it is at a great diſtance. Plate CCCLIII.

He found, that it was not material whether the hair was ſurrounded with air, or with any other pellucid ſubſtance;

ſubſtance; for he wetted a poliſhed plate of glaſs, and laid the hair in the water upon the glaſs, and then laying another poliſhed plate of glaſs upon it, ſo that the water might fill up the ſpace between the glaſſes, and holding them in the beam of light, he found the ſhadow at the ſame diſtances was as big as before. Alſo the ſhadows of ſcratches made in poliſhed plates of glaſs, and the veins in the glaſs, caſt the like broad ſhadows: ſo that this breadth of ſhadow muſt proceed from ſome other cauſe than the refraction of the air.

The ſhadows of all bodies, metals, ſtones, glaſs, wood, horn, ice, &c. in this light were bordered with three parallel fringes, or bands of coloured light, of which that which was contiguous to the ſhadow was the broadeſt and moſt luminous, while that which was the moſt remote was the narroweſt, and ſo faint as not eaſily to be viſible. It was difficult to diſtinguiſh theſe colours, unleſs when the light fell very obliquely upon a ſmooth paper, or ſome other ſmooth white body, ſo as to make them appear much broader than they would otherwiſe have done; but in theſe circumſtances the colours were plainly viſible, and in the following order. The firſt or innermoſt fringe was violet, and deep blue next the ſhadow, light blue, green, and yellow in the middle, and red without. The ſecond fringe was almoſt contiguous to the firſt, and the third to the ſecond; and both were blue within, and yellow and red without; but their colours were very faint, eſpecially thoſe of the third. The colours, therefore, proceeded in the following order from the ſhadow; violet, indigo, pale blue, green, yellow, red; blue, yellow, red; pale blue, pale yellow, and red. The ſhadows, made by ſcratches and bubbles in poliſhed plates of glaſs were bordered with the like fringes of coloured light.

He alſo obſerves, that by looking on the ſun through a feather, or black ribbon, held cloſe to the eye, ſeveral rainbows will appear, the ſhadows which the fibres or threads caſt on the retina being bordered with the like fringes of colours.

Meaſuring theſe fringes and their intervals with the greateſt accuracy, he found the former to be in the progreſſion of the numbers 1, $\sqrt{\frac{1}{3}}$, $\sqrt{\frac{1}{5}}$, and their intervals to be in the ſame progreſſion with them, that is, the fringes and their intervals together to be in continual progreſſion of the numbers 1, $\sqrt{\frac{1}{2}}$, $\sqrt{\frac{1}{3}}$, $\sqrt{\frac{1}{4}}$, $\sqrt{\frac{1}{5}}$, or thereabouts. And theſe proportions held the ſame very nearly at all diſtances from the hair, the dark intervals of the fringes being as broad in proportion to the breadth of the fringes at their firſt appearance as afterwards, at great diſtances from the hair, though not ſo dark and diſtinct.

In the next obſervation of our author, we find a very remarkable and curious appearance, which we ſhould hardly have expected from the circumſtances, though it is pretty ſimilar to one that was noticed by Dr Hooke. The ſun ſhining into his darkened chamber, through a hole $\frac{1}{4}$ of an inch broad, he placed, at the diſtance of two or three feet from the hole, a ſheet of paſteboard, black on both ſides; and in the middle of it he had made a hole about $\frac{1}{4}$ of an inch ſquare, for the light to paſs through; and behind the hole he faſtened to the paſteboard the blade of a ſharp knife, to intercept ſome part of the light which paſſed through the hole. The planes of the paſteboard and blade of the knife were parallel to one another, and perpendicular to the rays; and when they were ſo placed that none of the light fell on the paſteboard, but all of it paſſed through the hole to the knife, and there part of it fell upon the blade of the knife, and part of it paſſed by its edge, he let that part of the light which paſſed by fall on a white paper, 2 or 3 feet beyond the knife, and there ſaw two ſtreams of faint light ſhoot out both ways from the beam of light into the ſhadow, like the tails of comets. But becauſe the ſun's direct light, by its brightneſs upon the paper, obſcured theſe faint ſtreams, ſo that he could ſcarce ſee them, he made a little hole in the midſt of the paper for that light to paſs through and fall on a black cloth behind it; and then he ſaw the two ſtreams plainly. They were like one another, and pretty nearly equal in length, breadth, and quantity of light. Their light, at that end which was next to the ſun's direct light, was pretty ſtrong for the ſpace of about $\frac{1}{4}$ of an inch, or $\frac{1}{2}$ of an inch, and decreaſed gradually till it became inſenſible.

The whole length of either of theſe ſtreams, meaſured upon the paper, at the diſtance of 3 feet from the knife, was about 6 or 8 inches; ſo that it ſubtended an angle, at the edge of the knife, of about 10 or 12, or at moſt 14, degrees. Yet ſometimes he thought he ſaw it ſhoot 3 or 4 degrees farther; but with a light ſo very faint, that he could hardly perceive it. This light he ſuſpected might, in part at leaſt, ariſe from ſome other cauſe than the two ſtreams. For, placing his eye in that light, beyond the end of that ſtream which was behind the knife, and looking towards the knife, he could ſee a line of light upon its edge; and that not only when his eye was in the line of the ſtreams, but alſo when it was out of that line, either towards the point of the knife, or towards the handle. This line of light appeared contiguous to the edge of the knife, and was narrower than the light of the innermoſt fringe, and narroweſt when his eye was fartheſt from the direct light; and therefore ſeemed to paſs between the light of that fringe and the edge of the knife; and that which paſſed neareſt the edge ſeemed to be moſt bent, though not all of it.

He then placed another knife by the former, ſo that their edges might be parallel, and look towards one another, and that the beam of light might fall upon both the knives, and ſome part of it paſs between their edges. In this ſituation he obſerved, that when the diſtance of their edges was about the 400th part of an inch, the ſtream divided in the middle, and left a ſhadow between the two parts. This ſhadow was ſo black and dark, that all the light which paſſed between the knives ſeemed to be bent and turned aſide to the one hand or the other; and as the knives ſtill approached one another, the ſhadow grew broader and the ſtreams ſhorter next to it, till, upon the contact of the knives, all the light vaniſhed.

From this experiment our author concludes, that the light which is leaſt bent, and which goes to the inward ends of the ſtreams, paſſes by the edges of the knives at the greateſt diſtance; and this diſtance, when the ſhadow began to appear between the ſtreams, was about the 800th part of an inch; and the light which paſſed by the edges of the knives at diſtances ſtill leſs

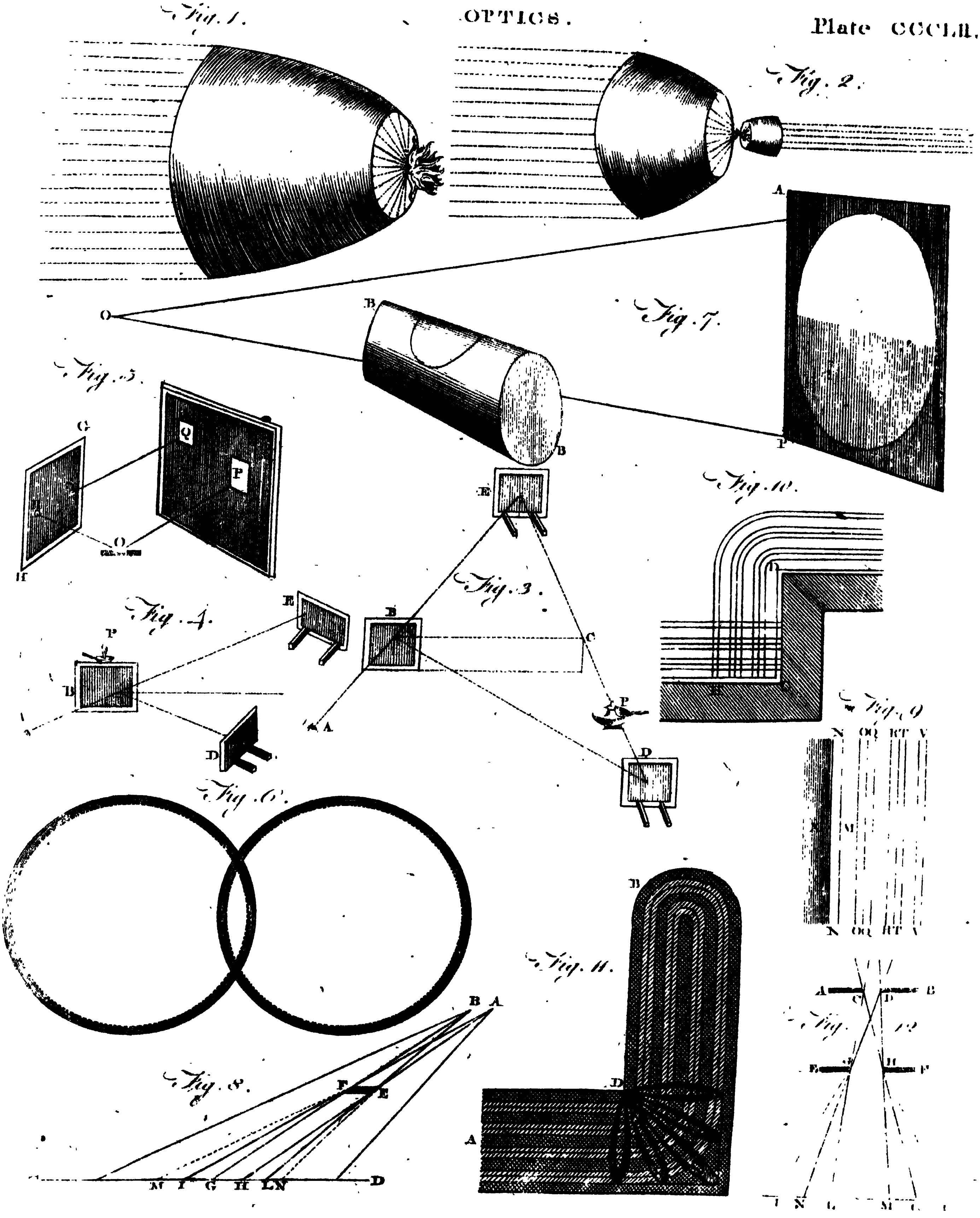


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.
Fig. 11.
Fig. 12.

and leſs, was more and more faint, and went to thoſe parts of the ſtreams which were farther from the direct light; becauſe, when the knives approached one another till they touched, thoſe parts of the ſtreams vaniſhed laſt which were fartheſt from the direct light.

In the experiment of one knife only, the coloured fringes did not appear; but, on account of the breadth of the hole in the window, became ſo broad as to run into one another, and, by joining, to make one continual light in the beginning of the ſtreams; but in the laſt experiment, as the knives approached one another, a little before the ſhadow appeared between the two ſtreams, the fringes began to appear on the inner ends of the ſtreams, on either ſide of the direct light; three on one ſide, made by the edge of one knife, and three on the other ſide, made by the edge of the other knife. They were the moſt diſtinct when the knives were placed at the greateſt diſtance from the hole in the window, and became ſtill more diſtinct by making the hole leſs; ſo that he could ſometimes ſee a faint trace of a fourth fringe beyond the three above mentioned: and as the knives approached one another the fringes grew more diſtinct and larger, till they vaniſhed; the outermoſt vaniſhing firſt, and the innermoſt laſt. After they were all vaniſhed, and the line of light which was in the middle between them was grown very broad, extending itſelf on both ſides into the ſtreams of light deſcribed before, the above-mentioned ſhadow began to appear in the middle of this line, and to divide it along the middle into two lines of light, and increaſed till all the light vaniſhed. This enlargement of the fringes was ſo great, that the rays which went to the innermoſt fringe ſeemed to be bent about 20 times more when the fringe was ready to vaniſh, than when one of the knives was taken away.

From both theſe experiments compared together, our author concluded, that the light of the firſt fringe paſſed by the edge of the knife at a diſtance greater than the 800th part of an inch; that the light of the ſecond fringe paſſed by the edge of the knife at a greater diſtance than the light of the firſt fringe, and that of the third at a greater diſtance than that of the ſecond; and that the light of which the ſtreams above mentioned conſiſted, paſſed by the edges of the knives at leſs diſtances than that of any of the fringes.

He then got the edges of two knives ground truly ſtraight, and pricking their points into a board, ſo that their edges might look towards one another, and meeting near their points, contain a rectilinear angle, he faſtened their handles together, to make the angle invariable. The diſtance of the edges of the knives from one another, at the diſtance of four inches from the angular point, where the edges of the knives met, was the 8th part of an inch; ſo that the angle contained by their edges was about 1° 54′. The knives being thus fixed together, he placed them in a beam of the ſun's light let into his darkened chamber, through a hole the 42d part of an inch wide, at the diſtance of 10 or 13 feet from the hole; and he let the light which paſſed between their edges fall very obliquely on a ſmooth white ruler, at the diſtance of ½ inch, or an inch, from the knives; and there he ſaw the fringes made by the two edges of the knives run along the edges of the ſhadows of the knives, in lines parallel to thoſe edges, without growing ſenſibly broader, till they met in angles equal to the angle contained by the edges of the knives; and where they met and joined, they ended, without croſſing one another. But if the ruler was held at a much greater diſtance from the knives, the fringes, where they were farther from the place of their meeting, were a little narrower, and they became ſomething broader as they approached nearer to one another, and after they met they croſſed one another, and then became much broader than before.

From theſe obſervations he concluded, that the diſtances at which the light compoſing the fringes paſſed by the knives were not increaſed or altered by the approach of the knives, but that the angles in which the rays were there bent were much increaſed by that approach; and that the knife which was neareſt to any ray determined which way the ray ſhould be bent, but that the other knife increaſed the bending.

When the rays fell very obliquely upon the ruler, at the diſtance of a third part of an inch from the knives, the dark line between the firſt and ſecond fringe of the ſhadow of one knife, and the dark line between the firſt and ſecond fringe of the ſhadow of the other knife, met one another, at the diſtance of the fifth part of an inch from the end of the light which paſſed between the knives, where their edges met one another; ſo that the diſtance of the edges of the knives, at the meeting of the dark lines, was the 160th part of an inch; and one half of that light paſſed by the edge of one knife, at a diſtance not greater than the 320th part of an inch, and, falling upon the paper, made the fringes of the ſhadow of that knife; while the other half paſſed by the edge of the other knife, at a diſtance not greater than the 320th part of an inch, and, falling upon the paper, made the fringes of the ſhadow of the other knife. But if the paper was held at a diſtance from the knives greater than the third part of an inch, the dark lines above mentioned met at a greater diſtance than the fifth part of an inch from the end of the light which paſſed between the knives, at the meeting of their edges; ſo that the light which fell upon the paper where thoſe dark lines met paſſed between the knives, where their edges were farther diſtant than the 160th part of an inch. For at another time, when the two knives were 8 feet and 5 inches from the little hole in the window, the light which fell upon the paper where the above-mentioned dark lines met paſſed between the knives, where the diſtance between their edges was, as in the following table, at the diſtances from the paper there noted.

| Diſtances of the paper from the knives in inches. | Diſtance between the edges of the knives in milleſimal parts of an inch. |
|---|---|
| | 0,012 |
| | 0,020 |
| 8 | 0,034 |
| 32 | 0,057 |
| 96 | 0,081 |
| 131 | 0,087 |

From theſe obſervations he concluded, that the light

light which makes the fringes upon the paper is not the same light at all distances of the paper from the knives; but that when the paper is held near the knives, the fringes are made by light which passes by the edges of the knives at a less distance, and is more bent than when the paper is held at a greater distance from the knives.

When the fringes of the shadows of the knives fell perpendicularly upon the paper, at a great distance from the knives, they were in the form of hyperbolas, their dimensions being as follow. Let CA, CB, represent lines drawn upon the paper, parallel to the edges of the knives; and between which all the light would fall if it suffered no inflection. DE is a right line drawn through C, making the angles ACD, BCE, equal to one another, and terminating all the light which falls upon the paper, from the point where the edges of the knives meet. Then *e i s*, *f k t*, and *g l v*, will be three hyperbolical lines, representing the boundaries of the shadow of one of the knives, the dark line between the first and second fringes of that shadow, and the dark line between the second and third fringes of the same shadow. Also *x i p*, *y k q*, and *z l r*, will be three other hyperbolical lines, representing the boundaries of the shadow of the other knife, the dark line between the first and second fringes of that shadow, and the dark line between the second and third fringes of the same shadow. These three hyperbolas are similar, and equal to the former three, and cross them in the points *i*, *k*, and *l*; so that the shadows of the knives are terminated, and distinguished from the first luminous fringes, by the lines *e i s* and *x i p*, till the meeting and crossing of the fringes; and then those lines cross the fringes in the form of dark lines terminating the first luminous fringes on the inside, and distinguishing them from another light, which begins to appear at *i*, and illuminates all the triangular space *i p* DE*s*, comprehended by these dark lines and the right line DE. Of these hyperbolas one asymptote is the line DE, and the other asymptotes are parallel to the lines CA and CB.

Plate CCLIII. fig. 2.

The sun shining into his darkened room through the small hole mentioned above, he placed at the hole a prism to refract the light, and to form on the opposite wall the coloured image of the sun; and he found that the shadows of all bodies held in the coloured light between the prism and the wall, were bordered with fringes of the colour of that light in which they were held; and comparing the fringes made in the several coloured lights, he found that those made in the red light were the largest, those made in the violet were the least, and those made in the green were of a middle bigness. For the fringes with which the shadow of a man's hair were bordered, being measured cross the shadow, at the distance of six inches from the hair, the distance between the middle and most luminous part of the first or innermost fringe on one side of the shadow, and that of the like fringe on the other side of the shadow, was, in the full red light $\frac{1}{37\frac{1}{2}}$ of an inch, and in the full violet $\frac{1}{37}$. The like distance between the middle and most luminous parts of the second fringes, on either side of the shadow, was in the full red light $\frac{1}{22}$ and the violet $\frac{1}{27}$ of an inch; and these distances of the fringes held the same proportion at all distances from the hair, without any sensible variation.

From these observations it was evident, that the rays which made the fringes in the red light, passed by the hair at a greater distance than those which made the like fringes in the violet; so that the hair, in causing these fringes, acted alike upon the red light or least refrangible rays at a greater distance, and upon the violet or most refrangible rays at a less distance; and thereby occasioned fringes of different sizes, without any change in the colour of any sort of light.

It may therefore be concluded, that when the hair in the first observation was held in the white beam of the sun's light, and cast a shadow which was bordered with three fringes of coloured light, those colours arose not from any new modifications impressed upon the rays of light by the hair, but only from the various inflections whereby the several sorts of rays were separated from one another, which before separation, by the mixture of all their colours, composed the white beam of the sun's light; but, when separated, composed lights of the several colours which they are originally disposed to exhibit.

53 Miraldi's discoveries.

The person whose name we find first upon the list of those who pursued any experiments similar to those of Newton on inflected light is M. Miraldi; whose observations chiefly respect the inflection of light towards other bodies, whereby their shadows are partially illuminated; and many of the circumstances which he noticed relating to it are well worthy of our attention, as the reader will be convinced from the following account of them.

54 Experiments concerning the shadows of cylinders.

He exposed in the light of the sun a cylinder of wood three feet long, and $6\frac{1}{2}$ lines in diameter; when its shadow, being received upon a paper held close to it, was everywhere equally black and well defined, and continued to be so to the distance of 23 inches from it. At a greater distance the shadow appeared to be of two different densities; for the two extremities of the shadow, in the direction of the length of the cylinder, were terminated by two dark strokes, a little more than a line in breadth. Within these dark lines there was a faint light, equally dispersed through the shadow, which formed an uniform penumbra, much lighter than the dark strokes at the extremity, or than the shadow received near the cylinder. This appearance is represented in Plate CCLIII. fig. 3.

As the cylinder was removed to a greater distance from the paper, the two black lines continued to be nearly of the same breadth, and the same degree of obscurity; but the penumbra in the middle grew lighter, and its breadth diminished, so that the two dark lines at the extremity of the shadow approached one another, till at the distance of 60 inches, they coincided, and the penumbra in the middle entirely vanished. At a still greater distance a faint penumbra was visible; but it was ill defined, and grew broader as the cylinder was removed farther off, but was sensible at a very great distance.

Besides the black and dark shadow which the cylinder formed near the opaque body, a narrow and faint penumbra was seen on the outside of the dark shadow. And on the outside of this there was a tract more strongly illuminated than the rest of the paper.

The

The breadth of the external penumbra increaſed with the diſtance of the ſhadow from the cylinder, and the breadth of the tract of light on the outſide of it was alſo enlarged; but its ſplendour diminiſhed with the diſtance.

He repeated theſe experiments with three other cylinders of different dimenſions: and from them all he inferred, that every opaque cylindrical body, expoſed to the light of the ſun, makes a ſhadow which is black and dark to the diſtance of 38 to 45 diameters of the cylinder which forms it; and that, at a greater diſtance, the middle part begins to be illuminated in the manner deſcribed above.

In explaining theſe appearances, our author ſuppoſes that the light which diluted the middle part of the ſhadow was occaſioned by the infl[illegible] of the [illegible], which, bending inwards on their near approach to the body, did at a certain diſtance enlighten all the ſhadow, except the edges, which were left undiſturbed. At the ſame time other rays were deflected from the body, and formed a ſtrong light on the outſide of the ſhadow, and which might at the ſame time contribute to dilute the outer ſhadow, though he ſuppoſed that penumbra to be occaſioned principally by that part of the paper not being enlightened, except by a part of the ſun's diſk only, according to the known principles of optics.

55 Concerning thoſe of globes.

The ſame experiments he made with globes of ſeveral diameters; but he found, that, whereas the ſhadows of the cylinders did not diſappear but at the diſtance of 41 of their diameters, thoſe of the globes were not viſible beyond 15 of their diameters; which he thought was owing to the light being inflected on every ſide of a globe, and conſequently in ſuch a quantity as to diſperſe the ſhadows ſooner than in the caſe of the cylinders.

In all theſe caſes, the penumbra occaſioned by the inflected light began to be viſible at a leſs diſtance from the body in the ſtronger light of the ſun than in a weaker, on account of the greater quantity of rays inflected in thoſe circumſtances.

56 His miſtake concerning the moon.

Conſidering the analogy between theſe experiments and the phenomena of an eclipſe of the moon, immerſed in the ſhadow of the earth, he imagined, that part of the light by which ſhe is then viſible is inflected light, and not that which is refracted by the atmoſphere; though this may be ſo copious as to efface ſeveral of the above mentioned appearances, occaſioned by inflected light only. But this gentleman ſhould have conſidered, that as no light is inflected but what paſſes exceedingly near to any body, perhaps ſo near as the diſtance of $\frac{1}{30}$ part of an inch, this cauſe muſt be altogether inadequate to the effect.

Being ſenſible that the above-mentioned phenomena of the ſhadows were cauſed by inflected light, he was induced to give more particular attention to this remarkable property; and, in order to it, to repeat the experiments of Grimaldi and Sir Iſaac Newton in a darkened room. In doing this, he preſently obſerved that, beſides the enlarged ſhadow of a hair, a fine needle, &c. the bright gleam of light that bordered it, and the three coloured rings next to this enlightened part, when the ſhadow was at a conſiderable diſtance from the hair, the dark central ſhadow was divided in the middle by a mixture of light; and that it was not of the ſame denſity, except when it was very near the hair.

This new appearance will be ſeen to be exactly ſimilar to what our philoſopher had obſerved with reſpect to the ſhadows in the open day-light above mentioned; but the following obſervations, which he made with ſome variation of his apparatus, are much more curious and ſtriking, though they ariſe from the ſame cauſe.

Having placed a briſtle, which is thicker than a common hair, in the rays of the ſun, admitted into a dark chamber by a ſmall hole, at the diſtance of nine feet from the hole, it made a ſhadow, which, being received at five or ſix feet from the object, he obſerved to conſiſt of ſeveral ſtreaks of light and ſhade. The middle part was a faint ſhadow, or rather a kind of penumbra, bordered by a darker ſhadow, and after that by a narrower penumbra; next to which was a light ſtreak broader than the dark part, and next to the ſtreak of light, the red, violet, and blue colours were ſeen as in the ſhadow of the hair.

In the ſame manner he placed, in the ſame rays of the ſun, ſeveral needles of different ſizes; but the appearances were ſo exceedingly various, though ſufficiently ſingular, that he does not recite them particularly, but chooſes rather to give, at ſome length, the obſervations he made on the ſhadows of two plates, as by that means he could better explain the phenomena of the round bodies.

He expoſed in the rays of the ſun, admitted by a ſmall hole into a dark chamber, a plate that was two inches long, and a little more than half a line broad. This plate being fixed perpendicularly to the rays, at the diſtance of nine feet from the hole, a faint light was ſeen uniformly diſperſed over the ſhadow, when it was received perpendicularly to it, and very near. The ſhadow of the ſame plate being received at the diſtance of two feet and a half, was divided into four very narrow black ſtreaks, ſeparated by ſmall lighter intervals equal to them. The boundaries of this ſhadow on each ſide had a penumbra, which was terminated by a very ſtrong light, next to which were the coloured ſtreaks of red, violet, and blue, as before. This is repreſented in Plate CCLIII. fig. 4. 57 Experiments concerning the ſhadow of p[illegible]

The ſhadow of the ſame plate, at 4½ feet diſtance from it, was divided into two black ſtreaks only, the two outermoſt having diſappeared, as in fig. 5.; but theſe two black ſtreaks which remained were broader than before, and ſeparated by a lighter ſhade, twice as broad as one of the former black ſtreaks, when the ſhadow was taken at 2½ feet. This penumbra in the middle had a tinge of red. After the two black ſtreaks there appeared a pretty ſtrong penumbra, terminated by the two ſtreaks of light, which were now broad and ſplendid, after which followed the coloured ſtreaks.

A ſecond plate, two inches long and a line broad, being placed like the former, 14 feet from the hole by which the rays of the ſun were admitted, its ſhadow being received perpendicularly very near the plate, was illuminated by a faint light, equally diſperſed, as in the caſe of the preceding plate. But being received at the diſtance of 13 feet from the plate, ſix ſmall black

Plate CCCLIII.

ſtreaks began to be viſible, as in fig. 6. At 17 feet from the plate, the black ſtreaks were broader, more diſtinct, and more ſeparated from the ſtreaks that were leſs dark. At 42 feet from the plate, only two black ſtreaks were ſeen in the middle of the penumbra, as in fig. 7. This middle penumbra between the two black ſtreaks was tinged with red. Next to the black ſtreaks there always appeared the ſtreaks of light, which were broad, and the coloured ſtreaks next to them.

Receiving the ſhadow of the ſame plate at the diſtance of 72 feet, the appearances were the ſame as in the former ſituation, except that the two black ſtreaks were broader, and the interval between them, occupied by the penumbra, was broader alſo, and tinged with a deeper red.

In the ſame rays of the ſun he placed different plates, and larger than the former, one of them a line and a half, another two lines, another three lines broad, &c. but receiving their ſhadows upon paper, he could not perceive in them thoſe ſtreaks of faint light which he had obſerved in the ſhadows of the ſmall plates, though he received theſe ſhadows at the diſtance of 56 feet. Nothing was ſeen but a weak light, equally diffuſed, as in the ſhadows of the two ſmalleſt plates, received very near them. But had his dark chamber been large enough, he did not doubt, but that, at a proper diſtance, there would have been the ſame appearances in the ſhadows of the larger plates as in thoſe of the ſmalleſt. For the ſame reaſon, he ſuppoſed, that, if the ſhadows of the ſmall needles could have been diſtinctly viewed very near thoſe bodies, the different ſtreaks of light and ſhade would have been as viſible in them as in thoſe of the ſmall plates; and indeed he did obſerve the ſame appearances in the ſhadows of needles of a middling ſize.

The ſtreaks of light in theſe ſhadows our author aſcribed to the rays of light which are inflected at different diſtances from the bodies; and he imagined that their croſſing one another was ſufficient to account for the variations obſervable in them at different diſtances.

The extraordinary ſize of the ſhadows of theſe ſmall ſubſtances M. Miraldi thought to be occaſioned by the ſhadow from the enlightened part of the ſky, added to that which was made by the light of the ſun, and alſo to a vortex occaſioned by the circulation of the inflected light behind the object; but our readers will probably not think it neceſſary for us either to produce all his reaſons for this hypotheſis, or to enter into a refutation of them.

Our author having made the preceding experiments upon ſingle long ſubſtances, had the curioſity to place two of them ſo as to croſs one another in a beam of the ſun's light. The ſhadows of two hairs placed in this manner, and received at ſome diſtance from them, appeared to be painted reciprocally one upon the other, ſo that the obſcure part of one of them was viſible upon the obſcure part of the other. The ſtreaks of light alſo croſſed one another, and the coloured ſtreaks did the ſame.

Having placed a needle and a hair croſſing one another, their ſhadows, at the ſame diſtance, exhibited the ſame appearances as the ſhadows of the two hairs, though the ſhadow of the needle was the ſtronger.

He alſo placed in the rays of the ſun a briſtle and a plate of iron a line thick, ſo that they croſſed one another obliquely; and when their ſhadows were received at the ſame diſtance, the light and dark ſtreaks of the ſhadow of the briſtle were viſible ſo far as the middle of the ſhadow of the plate on the ſide of the acute angle, but not on the ſide of the obtuſe angle, whether the briſtle or the plate were placed next to the rays. The plate made a ſhadow ſufficiently dark, divided into ſix black ſtreaks; and theſe were again divided by as many light ones equal to them; and yet all the ſtreaks belonging to the ſhadow of the briſtle were viſible upon it, as in fig. 8. To explain this appearance, he ſuppoſed that the rays of the ſun glided a little along the briſtle, ſo as to enlighten part of that which was behind the plate. But this ſeems to be an arbitrary and improbable ſuppoſition.

Our philoſopher did not fail to expoſe ſeveral ſmall globes in the light of the ſun in his dark chamber, and to compare their ſhadows with thoſe of the long ſubſtances, as he had done in the day light, and the appearances were ſtill ſimilar. It was particularly evident, that there was much more light in the ſhadows of the globes than in thoſe of the cylinders, not only when they were both of an equal diameter, but when that of the globe was larger than that of the cylinder, and the ſhadows of both the bodies were received at the ſame diſtance. He alſo obſerved, that he could perceive no difference of light in the ſhadows of the plates which were a little more than one line broad, though they were received at the diſtance of 72 feet; but he could eaſily ſee a difference of ſhades in thoſe of the globes, taken at the ſame diſtance, though they were $2\frac{1}{2}$ lines in diameter.

In order to explain the colours at the edges of theſe ſhadows, he contrived to throw ſome of the ſhadows upon others; and the following obſervations, though they did not enable him to accompliſh what he intended, are curious and worth reciting.

58 Experiments with a mixture of coloured ſhadows.

Having thrown ſeveral of the ſimilar colours upon one another, and thereby produced a tinge more lively than before, he threw the gleam of light, which always intervened between the colours and the darker part of the ſhadow, upon different parts of other ſhadows; and obſerved, that, when it fell upon the exterior penumbra made by another needle, it produced a beautiful ſky blue colour, almoſt like that which was produced by two blue colours thrown together. When the ſame gleam of light fell upon the deeper ſhadow in the middle, it produced a red colour; which ſeemed to prove, that the reddiſh colour in the middle of ſeveral of the ſhadows might come from the little light inflected into that place. But here our author ſeems to have been miſled by ſome falſe hypotheſis concerning colours.

He placed two plates of iron, each three or four lines broad, very near one another, but with a very ſmall interval between them: and having placed them in the rays of the ſun, and received their ſhadows at the diſtance of 15 or 20 feet from them, he ſaw no light between them but a continued ſhadow, in the middle

middle of which were some streaks of a lively purple, parallel to one another, and separated by other black streaks; but between them there were other streaks, both of a very faint green, and also of a pale yellow.—He also informs us, that M. Delisle had observed colours in the streaks of light and shade, which are observable in shadows taken near the bodies.

59 M. Mairan's observations.

Among those who followed Sir Isaac Newton in his observations on the inflection of light, we also find the ingenious M. Mairan: but, without attempting the discovery of new facts, he only endeavoured to explain the old ones, by the hypothesis of an atmosphere surrounding all bodies; and consequently making two reflections and refractions of the light that impinges upon them, one at the surface of the atmosphere, and the other at that of the body itself. This atmosphere he supposed to be of a variable density and refractive power, like the air.

60 Discoveries of M. Du Tour.

M. Mairan was succeeded by M. Du Tour, who thought the variable atmosphere superfluous, and imagined that he could account for all the phenomena by the help of an atmosphere of an uniform density, and of a less refractive power than the air surrounding all bodies. But what we are most obliged to this gentleman for, is, not his ingenious *hypothesis*, but the beautiful variety with which he has exhibited the *experiments*, which will render it much easier for any person to investigate the true causes of them.

Before M. Du Tour gave his attention to this subject, only three fringes had been observed in the colours produced by the inflection of light; but he was accidentally led to observe a greater number of them, and adopted from Grimaldi the following ingenious method of making them all appear very distinct.

Plate CCCLIII.

He took a circular board ABED (fig. 9.), 13 inches in diameter, the surface of which was black, except at the edge, where there was a ring of white paper about three lines broad, in order to trace the circumference of a circle, divided into 360 degrees, beginning at the point A, and reckoning 180 degrees on each hand to the point E; B and D being each of them placed at 90 degrees. A slip of parchment three inches broad, and disposed in the form of a hoop, was fastened round the board, and pierced at the point E with a square hole, each side being four or five lines, in order to introduce a ray of the sun's light. Lastly, In the centre of the board C, and perpendicular to it, he fixed a pin about $\frac{1}{4}$ of a line in diameter.

This hoop being so disposed, that a ray of light entering the dark chamber, through a vertical cleft of two lines and a half in length, and about as wide as the diameter of the pin, went through the hole at E, and passing parallel to the plane of the board, projected the image of the sun and the shadow of the pin at A. In these circumstances he observed,

1. That quite round the concave surface of this hoop, there were a multitude of coloured streaks; but that the space *mAn*, of about 18 degrees, the middle of which was occupied by the image of the sun, was covered with a faint light only.

2. The order of the colours in these streaks was generally such that the most refrangible rays were the nearest to the incident ray ECA; so that, beginning from the point A, the violet was the first and the red the last colour in each of the streaks. In some of them, however, the colours were disposed in a contrary order.

3. The image of the sun, projected on each side of the point A, was divided by the shadow of the pin, which was bordered by two luminous streaks.

4. The coloured streaks were narrower in some parts of the hoop than others, and generally decreased in breadth in receding from the point A.

5. Among these coloured streaks, there were sometimes others which were white, a line or a line and a half in breadth, which were always bordered on both sides by a streak of orange colour, at least when the light of the sun was intense, and the chamber sufficiently dark.

From this experiment he thought it was evident, that the rays which passed beyond the pin were not the only ones that were decomposed, for that those which were reflected back from the pin were decomposed also; from which he concluded that they must have undergone some refraction. He also thought that those which went beyond the pin suffered a reflection, so that they were all affected in a similar manner.

In order to account for these facts our author describes the progress of a ray of light through an uniform atmosphere, which he supposes to surround the pin; and shows, that the differently refrangible rays will be separated at their emergence from it: but he refers to some experiments and observations in a future memoir, to demonstrate that all the coloured streaks are produced by rays that are both reflected and refracted.

61 Account of Du Tour's hypothesis.

To give some idea of his hypothesis, he shows that the ray *a b*, fig. 10. after being refracted at *b*, reflected at *r* and *u*, and again refracted at *s* and *t*, will be divided into its proper colours; the least refrangible or the red rays issuing at *x*, and the most refrangible or violet at *y*; which agrees with his observations. Those streaks in which the colours appear in a contrary order he thinks are to be ascribed to inequalities in the surface of the pin. This might easily have been ascertained by turning the pin round; in which case these differently coloured streaks would have changed their places.

If any person should choose to repeat these experiments, he observes that it requires that the sky be very clear and free from vapours, in order to exhibit the colours with the greatest distinctness; since even the vapours that are imperceptible will diminish the lustre of the colours on every part of the hoop, and even efface some of them, especially those which are on that part in which the beam of light enters, as at E, fig. 9. where the colours are always fainter than in any other place, and indeed can never be distinguished except when the hole E is confined by black substances, so as to intercept a part of the light that might reach the pin; and unless also those rays which go beyond the pin to form the image of the sun at A be stopped, so that no rays are visible except those that are reflected towards the hole, and which make the faint streaks.

The coloured streaks that are next the shadow of the pin, he shows, are formed by those rays which, entering the atmosphere, do not fall upon the pin; and, without any reflection, are only refracted at their entering

Plate CCCLIII.

entering and leaving the atmoſphere, as at *b* and *r u*, fig. 11. In this caſe, the red or leaſt refrangible rays will iſſue at *r*, and the violet at *u*.

To diſtinguiſh the rays which fell upon the hoop in any particular direction, from thoſe that came in any other, he made an opening in the hoop, as at P, fig. 9. by which means he could, with advantage, and at any diſtance from the centre, obſerve thoſe rays unmixed with any other.

To account for the coloured ſtreaks being larger next the ſhadow of the pin, and growing narrower to the place where the light was admitted, he ſhows, by fig. 12. that the rays *a b* are farther ſeparated by both the refractions than the rays *c d*.

Sometimes our author obſerved, that the broader ſtreaks were not diſpoſed in this regular order; but then he found, that by turning the pin they changed their places, ſo that this circumſtance muſt have been an irregularity depending upon the accidental ſurface of the pin.

The white ſtreaks intermixed with the coloured ones he aſcribes to ſmall cavities in the ſurface of the pin, or ſome other foreign circumſtance; for they alſo changed their places when the pin was made to turn upon its axis.

Other obſervations of our author ſeem to prove that the refracting atmoſpheres ſurrounding all kinds of bodies are of the ſame ſize; for when he placed a great variety of ſubſtances, and of different ſizes alſo, he always found the coloured ſtreaks of the ſame dimenſions.

M. Du Tour obſerves that his hypotheſis contradicts an obſervation of Sir Iſaac Newton, that thoſe rays which paſs the neareſt to any body are the moſt inflected; but he thinks that Newton's obſervations were not ſufficiently accurate. Beſides, he obſerves, that Newton only ſaid that *he thought it to be ſo*, without aſſerting it poſitively.

Since the rays which formed theſe coloured ſtreaks are but little diverted out of their way, our author infers that this atmoſphere is of ſmall extent, and that its refractive power is not much leſs than that of air.

Expoſing two pieces of paper in the beam of light, ſo that part of it paſſed between two planes formed by them, M. Du Tour obſerved, that the edges of this light, received upon paper, were bordered with two orange-coloured ſtreaks, which Newton had not taken notice of in any of his experiments. To account for them, he ſuppoſes, that, in fig. 13. the more refrangible of the rays which enter at *b* are ſo refracted, that they do not reach the ſurface of the body itſelf at R: ſo that the red and orange-coloured light may be reflected from thence in the direction *d*M, where the orange-coloured ſtreaks will be formed; and, for the ſame reaſon, another ſtreak of orange will be formed at *m*, by the rays which enter the atmoſphere on the other ſide of the chink. In a ſimilar manner he accounts for the orange-coloured fringes at the borders of the white ſtreaks, in the experiment of the hoop.

The blue rays, which are not reflected at R, he ſuppoſes, paſs on to I; and that of theſe rays the blue tinge obſervable in the ſhadows of ſome bodies are formed.

We may here make a general obſervation, applicable to all the attempts of philoſophers to explain theſe phenomena by atmoſpheres. These attempts give no explanation whatever of what is attempted, *i. e.* the phyſical cauſe of the phenomena. A phenomenon is ſome individual fact or event in nature. We are ſaid to explain it when we point out the *general fact* in which it is comprehended, and ſhow the manner in which it is ſo comprehended, or the particular modification of the general *fact*. Philoſophy reſembles natural hiſtory, having for its ſubject the *events* of nature; and its inveſtigations are nothing but the claſſification of theſe events, or the arrangement of them under the general facts of which they are individual inſtances. In the preſent inſtance there is no general *fact* referred to. The atmoſphere is a mere gratuitous ſuppoſition; and all that is done is to ſhow a reſemblance between the phenomena of inflection of light to what would be the phenomena were bodies ſurrounded with ſuch atmoſpheres; and even in this point of view, the diſcuſſions of Mairan and Du Tour are extremely deficient. They have been ſatisfied with very vague reſemblances to a fact obſerved in *one ſingle inſtance*, and not ſufficiently examined or deſcribed in that inſtance, namely, the refraction of light through the atmoſphere of this globe. 62 This hypotheſis uſeleſs and ill-founded.

The attempt is to explain how light is turned out of its direction by paſſing near the ſurface of bodies. This indicates the action of forces in a direction tranſverſe to that of the light. Newton took the right road of inveſtigation, by taking the phenomenon in its original ſimplicity, and attending merely to this, that the rays *are* deflected from their former courſe; and the ſole aim of his inveſtigation was to diſcover the laws, *i. e.* the more general facts in this deflection. He deduced from the phenomena, that ſome rays are more deflected than others, and endeavoured to determine in what rays the deflections are moſt remarkable: and no experiment of M. Du Tour has ſhown that he was miſtaken in his modified aſſertion, that thoſe rays are moſt inflected which paſs neareſt to the body. We ſay *modified aſſertion;* for Newton points out with great ſagacity many inſtances of alternate fits of *inflection* and *deflection;* and takes it for granted, that the law of continuity is obſerved in theſe phenomena, and that the chngae of inflection into deflection is gradual.

But theſe analogical diſcuſſions are eminently deficient in another reſpect: They are *(prima facie)* held out as mechanical explanations of the changes of motion obſerved in rays of light. When it ſhall be ſhown, that theſe are preciſely ſuch as are obſerved in refracting atmoſpheres, nothing is done towards deciding the original queſtion; for the action of refracting atmoſpheres preſents it in all its difficulties, and we muſt ſtill aſk *how do theſe atmoſpheres produce this effect?* No advance whatever is gained in ſcience by thruſting in this hypothetical atmoſphere; and Newton did wiſely in attaching himſelf to the ſimple fact: and he thus gives us another ſtep in ſcience, by ſhowing us a fact unknown before, *viz*, that the action of bodies on light is not confined to tranſparent bodies. He thus added another general fact to our former ſtock, *that light as well as other matter is acted on at a diſtance;* and thus he made a very important deduction, *that reflection,* 63 Reflection, refraction, and inflection probably produced by the ſame forces.

*flection, refraction, and inflection, are probably brought about by the same forces.*

We would extend this observation to all attempts of philosophers to explain the phenomena of nature by the *immediate* action of invisible fluids, magnetical, electrical, nervous, ethers, &c. and we would add that, all of them are equally illogical. They are all attempts to explain changes of motion by impulse; and proceed on the previous supposition, that the changes of motion by impulse are perfectly understood; a supposition quite gratuitous, nay false. We may challenge any philosopher to demonstrate, from unexceptionable principles, and by just argument, what will be the effect of one particle of matter in motion meeting with another particle at rest, these two particles constituting the whole of the universe. The question is to this day undecided.

But this is not all—changes of motion by impulse are very familiar, and the general laws are pretty well known; so that when it can be shown that impulse really operates in a phenomenon, we are satisfied with the explanation. When we see a glass ball hanging as a pendulum put in motion by the stroke of another equal ball similarly suspended, we think its motion is sufficiently explained by the common laws of collision. But this is a very incomplete view of the matter. It remains to be proved, that the motion was really produced by impulse, that is, by the one ball's coming into contact with the other; and we shall find that *real* impulse is far from being so familiar as we imagine.

When one object glass of a very long telescope lies upon another, nothing is observed at the place of contact of the two spherical glasses, unless the weight of the upper one be considerable; in which case a greasy-like spot is observed. If now the upper glass be pressed on the other, the spot will increase in diameter, and have a coloured margin. By gradually increasing the pressure, the breadth of the coloured spot will increase, and it will be found to consist of concentric arches of different colours, increasing in number and breadth by an increase of pressure. When this is sufficiently great, a black or unreflecting spot appears in the middle, sharply defined, with a silvery margin, and increasing in breadth with the pressure. No additional pressure makes any change excepting in the diameters of the coloured rings. When the pressure is gradually diminished, the rings contract, the black spot vanishes, and all the colours vanish in the contrary order to that of their first appearance. When the pressure is measured, which is necessary for producing the black spot, it is found considerably to exceed 800 pounds for every square inch of the black spot.

64 800 pounds weight on every square inch necessary to bring two bodies into apparent contact.

It is incontestably proved, that the coloured rings are produced by the reflection of light in those parts where the glasses are at certain small distances from each other, measurable by means of the diameters of the coloured rings and the diameter of the spheres, of which the adjoining surfaces of the glasses are portions; and the want of reflection in the middle seems to indicate the want of this necessary distance, and that the two glasses are there in contact, making but one, their surfaces being flattened by compression. The glasses seem to be kept asunder by mutual forces, which are overcome by external pressure, and which again separate them when the pressure is removed.

When therefore the glass ball mentioned above puts the other in motion by striking it, we are entitled to say, that unless the pressure during the stroke has been equal to 800 pounds for every square inch of contact, the motion has been produced without contact or real impulse, by the action of repulsive forces exerted between the balls, in the same manner as would happen between two magnets floating on cork with their north poles fronting each other; in which case (if the motion has been sufficiently slow) the striking magnet will be brought to rest, and the other move off, with its original velocity, in the same manner as happens to the glass balls. Many such communications of motion happen, where we cannot say that the impulsive pressure is greater than that now mentioned; and in such cases we are well entitled to say, that the motion has been produced without real impulse, by repulsive forces acting at a distance. This evidently diminishes to a great degree the familiarity of the fact of impulse.

65 Motion produced without impulse.

But we conclude too hastily, from the phenomena of the object glasses, that a pressure exceeding 800 pounds on the square inch will produce contact.

Blow a soap bubble, and let it fall on a piece of cloth, and cover it with a glass bell: after some time you will observe rings of colours on its upper part, which will increase in number and breadth, and be in every respect similar to those between the object glasses. These arise from the gradual thinning of the upper part of the soap bubble; a certain thickness of this, as well as of the interval between the glasses, invariably reflecting a certain colour. At last a black spot appears a-top, which is sharply defined, and increases in diameter. Soon after this the bubble bursts. Thus then there is a certain thickness necessary for enabling the plate of soap suds to reflect light so as to be very sensible. Analogy obliges us to extend this to the object glasses, and to say, not that the glasses touch each other through the extent of the black spot, but that their distance is there too small for the sensible reflection of light; and it remains undecided whether any pressure, however great, can annihilate all distance between them. So far, therefore, from impulse being a familiar fact, and its supposed laws being proper and logical principles of reasoning and explanation, it appears extremely doubtful whether the fact has *ever* been observed; and it must therefore be against the rules of logic to adduce the laws of impulse for the explanation of any abstruse phenomenon.

66 It is doubtful whether impulse has ever been observed.

Ether and other fluid atmospheres have often been resorted to by philosophers puzzled for an explanation; and all this trouble has been taken to avoid the supposed difficulty of bodies acting at a distance. We now see that this is only putting the difficulty a step farther off. We may here add, that in all these attempts the very thing is supposed which the philosophers wish to avoid. These ethers have been fitted for their tasks by supposing them of variable densities. It is quite easy to show, that such a variation in density cannot be conceived without supposing the particles to act on particles not in contact with them, and to a distance as great as that to which the change of density extends. The very simplest form of an elastic fluid supposes this, either with respect to its own particles, or with respect to the particles of a still more subtile

67 Supposed ethers unfit on account of the phenomena of inflection.

subtile fluid, from the interspersion of which it derives its elasticity. To get rid of one action at a distance, therefore, we introduce millions. Instead, therefore, of naturalists pluming themselves on such explanations, and having recourse, in all their difficulties, to the *ether of Sir Isaac Newton*, which they make a drudge, a *Mungo here, Mungo there, Mungo everywhere*; let us rather wonder how that great man, not more eminent for penetration and invention than for accuracy of conception and justness of reasoning, should so far forget himself, and deviate from that path of logical investigation in which he had most successfully advanced, and should, in his fabrication of ether, and application of it to explain the more abstruse phenomena of nature, at once transgress *all* the rules of philosophizing which he had prescribed to himself and others. Let this slip, this mark of frail mortality, put us on our guard, lest we also be seduced by the specious offers of explanation which are held out to us by means of invisible atmospheres of every kind.

68 *Objects sometimes magnified by the inflection of light.*

M. Le Cat has well explained a phenomenon of vision depending upon the inflection of light, which shows, that, in some cases objects appear magnified by this means. Looking at a distant steeple, when a wire, of a less diameter than the pupil of his eye, was held pretty near to it, and drawing it several times betwixt his eye and that object, he was surprised to find, that, every time the wire passed before his pupil, the steeple seemed to change its place, and some hills beyond the steeple seemed to have the same motion, just as if a lens had been drawn betwixt his eye and them.

Examining this appearance more attentively, he found that there was a position of the wire, but very difficult to keep, in which the steeple seemed not to have any motion, when the wire was passed before his eye; and in this case the steeple appeared less distinctly, and seemed to be magnified. These effects being similar to those of a lens, he attended to them more particularly; and placed his eye in such a manner with respect to the steeple, that the rays of light by which he saw it must come very close to the edge of a window, where he had placed himself to make his observations. Then passing the wire once more before his eye, he observed, that, when it was in the visual axis, the steeple appeared nearer to the window, on whichever side the wire was made to approach. He repeated this experiment, and constantly with the same result, the object being always magnified, and nearly doubled, by this means.

*Plate CCCLIII.*

This phenomenon is easily explained by fig. 14. in which B represents the eye, A the steeple, and C the diameter of the wire. The black lines express the cone of light by which the natural image of the steeple A is formed, and which is much narrower than the diameter of the wire C; but the dotted lines include not only that cone of light, stopped and turned out of its course by the wire, but also more distant rays inflected by the wire, and thereby thrown more converging into the pupil; just as would have been the effect of the interposition of a lens between the eye and the object. The result of this experiment was the same, whatever substances he made use of in the place of the wire, provided they were of the same diameter.

### § 5. *Discoveries concerning Vision.*

69 *Discoveries of Maurolycus, Kepler, &c. concerning vision.*

Maurolycus was the first who showed the true theory of vision, by demonstrating that the crystalline humour of the eye is a lens which collects the light issuing from external objects, and throws them upon the retina, where is the focus of each pencil. He did not however find out, that, by means of this refraction of the rays, an image of every visible object was formed upon the retina, though this seems hardly to have been a step beyond the discovery he had already made. Montucla indeed conjectures, that he was prevented from mentioning this part of the discovery by the difficulty of accounting for the upright appearance of objects, as the image on the retina is always inverted. This discovery was made by Kepler; but he, too, was much difficulted with the inverted position of the image. The rectification of these images, he says, is the business of the mind; which, when it perceives an impression on the lower part of the retina, considers it as made by rays proceeding from the higher parts of objects; tracing the rays back to the pupil, where they cross one another. But this hypothesis can scarcely be deemed satisfactory.—Kepler did not pretend to account for the manner in which the mind perceives the images upon the retina, and very much blames Vitellio for attempting prematurely to determine a question of this nature, and which indeed, he says, does not belong to optics. He accounts, however, though not in a satisfactory manner, for the power we have of seeing distinctly at different distances.

70 *Discoveries of Scheiner.*

The discovery concerning vision was completed by Scheiner. For, in cutting away the coats of the back part of the eyes of sheep and oxen, and presenting several objects before them, within the usual distance of vision, he saw their images distinctly and beautifully painted upon the retina. He did the same thing with the human eye, and exhibited this curious experiment at Rome in 1625. He takes particular notice of the resemblance between the eye and the camera obscura, and explains a variety of methods to make the images of objects erect. As to the images of objects being inverted in the eye, he acquiesces in the reason given for it by Kepler. He knew that the pupil of the eye is enlarged in order to view remote objects, and that it is contracted while we are viewing those that are near; and this he proved by experiment, and illustrated by figures.

Scheiner also took a good deal of pains to ascertain the density and refractive power of all the humours of the eye, by comparing their magnifying power with that of water or glass in the same form and circumstances. The result of his inquiries was, that the aqueous humour doth not differ much from water in this respect, nor the crystalline from glass; and that the vitreous humour is a medium between both. He also very accurately and minutely traces the progress of the rays of light through all the humours of the eye; and after discussing every possible hypothesis concerning the proper seat of vision, he demonstrates that it is in the retina, and shows that this was the opinion of Alhazen, Vitellio, Kepler, and all the most eminent philosophers. He produces many reasons of his own for this hypothesis; answers a great number of objections

objections to it; and, by a variety of arguments, refutes the opinion of former times, that the seat of vision is in the crystalline.

71 Discoveries of Descartes.

Descartes makes a good number of observations on the phenomena of vision. He explains satisfactorily the natural methods of judging of the magnitudes, situations, and distances, of objects, by the direction of the optic axes; comparing it to a blind man's judging of the size and distance of an object, by feeling at it with two sticks of a known length, when the hands in which he holds them are at a known distance from each other. He also observes, that having been accustomed to judge of the situation of objects by their images falling on a particular part of the eye; if by any distortion of the eye they fall on a different place, we are apt to mistake their situation, or imagine one object to be two; as till we become accustomed to it, we imagine one stick to be two, when it is placed between two contiguous fingers laid across one another. But he observes, that all the methods we have of judging of the distances of objects are very uncertain, and extend but to narrow limits. The direction of the optic axes, he says, will not serve us beyond 15 or 20 feet, and the change of form of the crystalline not more than three or four feet. For he imagined that the eye conforms itself to the view of near or distant objects by a change in the curvature of the crystalline which he supposed to be a muscle, the tendons of it being the processus ciliares. In another place, he says, that the change in the conformation of the eye is of no use to us for the purpose of judging of distances beyond four or five feet, and the angle of the optic axes not more than 100 or 200 feet: for this reason, he says, that the sun and moon are conceived to be much more nearly of the same size than they are in reality. White and luminous objects, he says, appear larger than others, and also the parts contiguous to those on which the rays actually impinge; and for the same reason, if the objects be small, and placed at a great distance, they will always appear round, the figure of the angles disappearing.

72 Berkeley's theory of vision.

The celebrated Berkeley bishop of Cloyne, published, in 1709, *An Essay towards a New Theory of Vision*, which contains the solution of many difficulties. He does not admit that it is by means of those lines and angles, which are extremely useful in explaining the theory of optics, that different distances are judged of by the sense of sight; neither does he think that the mere direction of the optic axes or the greater or less divergency of the rays of light are sufficient for this purpose. "I appeal (says he) to any one's experience, whether, upon sight of an *object*, he compute its distance by the bigness of the angle made by the meeting of the two *optic axes*? or whether he ever thinks of the greater or less divergency of the rays which arrive from any point to his pupil? Nay, whether it be not perfectly impossible for him to perceive, by sense, the various angles wherewith the rays according to their greater or lesser divergency fell upon his eye?" That there is a necessary connexion between these various angles, &c. and different degrees of distance, and that this connexion is known to every person skilled in optics, he readily acknowledges; but "in vain (says he) shall all the mathematicians in the world tell me, that I *perceive* certain *lines* and *angles*, which introduce into my mind the various notions of *distance*, so long as I am myself conscious of no such thing." Distance, magnitude, and even figure, he maintains to be the objects of immediate perception only by the sense of touch; and that when we judge of them by sight, it is from different sensations felt in the eye which experience has taught us to be the consequence of viewing objects of greater or less magnitude, of different figures, and at different distances. These various sensations, with the respective distances, figures, and magnitudes by which they are occasioned, become so closely associated in the mind long before the period of distinct recollection, that the presence of the one instantly suggests the other; and we attribute to the sense of sight those notions which are acquired by the sense of touch, and of which certain *visual* sensations are merely the signs or symbols, just as words are the symbols of ideas. Upon these principles he accounts, in a manner worthy of the reader's attention, for a single vision by both eyes, and for our perceiving objects erect by inverted images of them on the retina tunica. Subsequent writers have made great discoveries in the theory of vision; and among them there is hardly any one to whom this branch of science is so much indebted as to Dr Reid. Their reasonings, however, our limits will not permit us to detail, nor do they properly belong to this part of the article; they are connected with the description of the eye itself, the various modes of vision, and optical deceptions to which we are liable; and these will be considered in a succeeding part of this treatise.

### § 6. *Of Optical Instruments, and discoveries concerning them.*

73 Invention of spectacles.

So little were the ancients acquainted with the science of optics, that they seem to have had no instruments of the optical kind, excepting the glass globes and speculums formerly mentioned, which they used in some cases for magnifying and burning. Alhazen, as we have seen, gave the first hint of the invention of spectacles, and it is probable that they were found out soon after his time. From the writings of Alhazen, together with the observations and experiments of Roger Bacon, it is not improbable that some monks gradually hit upon the construction of spectacles; to which Bacon's lesser segment, notwithstanding his mistake concerning it, was a nearer approach than Alhazen's larger one. Whoever they were that pursued the discoveries of Bacon, they probably observed, that a very small convex glass, when held at a greater distance from the book, would magnify the letters more than when it was placed close to them, in which position only Bacon seems to have used it. In the next place, they might try whether two of these small segments of a sphere placed together, or a glass convex on both sides, would not magnify more than one of them. They would then find, that two of these glasses, one for each eye, would answer the purpose of reading better than one; and, lastly, they might find, that different degrees of convexity suited different persons.

It is certain that spectacles were well known in the 13th century, and not long before. It is said that Alexander

Alexander Spina, a native of Piſa, who died in 1313, and who was very ingenious in executing whatever he ſaw or heard of as having been done by others, happened to ſee a pair of ſpectacles in the hands of a perſon who would not explain them to him; but that he ſucceeded in making a pair for himſelf, and immediately made the conſtruction public for the good of others. It is alſo inſcribed on the tomb of Salvinus Armatus, a nobleman of Florence, who died 1317, that he was the inventor of ſpectacles.

74
Of concave glaſſes.

The uſe of concave glaſſes, to help thoſe perſons who are ſhort-ſighted, was probably a diſcovery that followed not long after that of convex ones, for the relief of thoſe whoſe ſight is defective in the contrary extreme, though we find no trace of this improvement. Whoever made this diſcovery, it was probably the reſult of nothing more than a random experiment. Perhaps a perſon who was ſhort-ſighted, finding that convex glaſſes did him more harm than good, had the curioſity to make trial of a contrary curvature of the glaſs.

75
Deſcartes's account of the invention of teleſcopes.

From this time, though both convex and concave lenſes were ſufficiently common, yet no attempt was made to form a teleſcope by a combination of them, till the end of the 16th century. Deſcartes conſiders James Metius, a perſon who was no mathematician, though his father and brother had applied to thoſe ſciences, as the firſt conſtructor of a teleſcope: and ſays, that as he was amuſing himſelf with making mirrors and burning glaſſes, he caſually thought of looking through two of his lenſes at a time; and that happening to take one that was convex and another that was concave, and happening alſo to hit upon a pretty good adjuſtment of them, he found, that, by looking through them, diſtant objects appeared very large and diſtinct. In fact, without knowing it, he had made a teleſcope.

76
Other accounts.

Other perſons ſay, that this great diſcovery was firſt made by John Lipperſheim, a maker of ſpectacles at Middleburgh, or rather by his children; who, like Metius, were diverting themſelves with looking through two glaſſes at a time, and placing them at different diſtances from one another. But Borellus, the author of a book entitled, *De vero teleſcopii inventore*, gives this honour to Zacharias Joannides, i. e. Janſen, another maker of ſpectacles at the ſame place, who made the firſt teleſcope in 1590; and it ſeems now to be the general opinion, that this account of Borellus is the moſt probable.

77
Borellus's account probably the true one.

Indeed, Borellus's account of the diſcovery of teleſcopes is ſo circumſtantial, and ſo well authenticated, that it does not ſeem poſſible to call it in queſtion. It is not true, he ſays, that this great diſcovery was made by a perſon who was no philoſopher: for Zacharias Janſen was a diligent inquirer into nature; and being engaged in theſe purſuits, he was trying what uſes could be made of lenſes for thoſe purpoſes, when he fortunately hit upon the conſtruction.

This ingenious mechanic, or rather philoſopher, had no ſooner found the arrangement of glaſſes that produced the effect he deſired, than he encloſed them in a tube, and ran with his inſtrument to Prince Maurice; who, immediately conceiving that it might be of uſe to him in his wars, deſired the author to keep it a ſecret. But this, though attempted for ſome time, was found to be impoſſible; and ſeveral perſons in that city immediately applied themſelves to the making and ſelling of teleſcopes. One of the moſt diſtinguiſhed of theſe was Hans Laprey, called *Lipperſheim* by Sirturus. By him ſome perſon in Holland being very early ſupplied with a teleſcope, he paſſed with many for the inventor; but both Metius above mentioned, and Cornelius Drebell of Alcmaar, in Holland, applied to the inventor himſelf in 1620; as alſo did Galileo, and many others. The firſt teleſcope made by Janſen did not exceed 15 or 16 inches in length; but Sirturus, who ſays that he had ſeen it, and made uſe of it, thought it the beſt that he had ever examined.

78
The firſt teleſcope an exceedingly good one.

Janſen, having a philoſophical turn, preſently applied his inſtrument to ſuch purpoſes as he had in view when he hit upon the conſtruction. Directing it towards celeſtial objects, he diſtinctly viewed the ſpots on the ſurface of the moon; and diſcovered many new ſtars, particularly ſeven pretty conſiderable ones in the Great Bear. His ſon Joannes Zacharias, noted the lucid circle near the limb of the moon, from whence ſeveral bright rays ſeemed to dart in different directions: and he ſays, that the full moon, viewed through this inſtrument, did not appear flat, but was evidently ſpherical, the middle part being prominent. Jupiter alſo, he ſays, appeared round, and rather ſpherical; and ſometimes he perceived two, ſometimes three, and at the moſt four ſmall ſtars, a little above or below him; and, as far as he could obſerve, they performed revolutions round him; but this, he ſays, he leaves to the conſideration of aſtronomers. This, it is probable, was the firſt obſervation of the ſatellites of Jupiter, though the perſon who made it was not aware of the importance of his diſcovery.

79
Honour of the invention claimed by Fontana.

One Francis Fontana, an Italian, alſo claims the invention; but as he did not pretend to have made it before the year 1608, and as it is well known that the inſtruments were made and ſold in Holland ſome time before, his pretenſions to a ſecond diſcovery are not much regarded.

80
A teleſcope made by Galileo without ſeeing one.

There are ſome who ſay that Galileo was the inventor of teleſcopes; but he himſelf acknowledges, that he firſt heard of the inſtrument from a German; but he ſays, that being informed of nothing more than the effects of it, firſt by common report, and a few days after by a French nobleman, J. Badovere, at Paris, he himſelf diſcovered the conſtruction, by conſidering the nature of refraction: and thus he had much more real merit than the inventor himſelf.

The account of what Galileo actually did in this buſineſs is ſo circumſtantially related by the author of his life, prefixed to the quarto edition of his works, printed at Venice in 1744, and it contains ſo many paticulars, which cannot but be pleaſing to every perſon who is intereſted in the hiſtory of teleſcopes, that we ſhall abridge a part of it, intermixing circumſtances collected from other accounts.

81
Account of his diſcoveries.

About April or May, in 1609, it was reported at Venice, where Galileo (who was profeſſor of mathematics in the univerſity of Padua) then happened to be, that a Dutchman had preſented to Count Maurice of Naſſau, a certain optical inſtrument, by means of which, diſtant objects appeared as if they were near; but no farther account of the diſcovery had reached that

that place, though this was near 20 years after the first discovery. Struck, however, with this account, Galileo instantly returned to Padua, considering what kind of an instrument this must be. The night following, the construction occurred to him; and the day after, putting the parts of the instrument together, as he had previously conceived of it, and notwithstanding the imperfection of the glasses that he could then procure, the effect answered his expectations, as he presently acquainted his friends at Venice, to which place he six days afterwards carried another and a better instrument that he had made, and where, from several eminences, he showed to some of the principal senators of that republic a variety of distant objects, to their very great astonishment. When he had made farther improvements in the instrument, he, with his usual generosity and frankness in communicating his discoveries, made a present of one of them to the Doge, Leonardo Donati, and at the same time to all the senate of Venice; giving along with the instrument a written paper, in which he explained the structure and wonderful uses that might be made of it both by land and at sea. In return for so noble an entertainment, the republic, on the 25th of August, in the same year, more than tripled his salary as professor.

Our philosopher, having amused himself for some time with the view of terrestrial objects, at length directed his tube towards the heavens; and, observing the moon, he found that the surface of it was diversified with hills and valleys, like the earth. He found that the *via lactea* and *nebulæ* consisted of a collection of fixed stars, which, on account either of their vast distance, or extreme smallness, were invisible to the naked eye. He also discovered innumerable fixed stars dispersed over the face of the heavens, which had been unknown to all the ancients; and examining Jupiter, with a better instrument than any he had made before, he found that he was accompanied by four stars, which, in certain fixed periods, performed revolutions round him, and which, in honour of the house of Medicis, he called *Medicean planets*.

This discovery he made in January 1610, new style; and continuing his observations the whole of February following, in the beginning of March next he published an account of all his discoveries, in his *Nuncius Sidereus*, printed at Venice, and dedicated to Cosmo great duke of Tuscany, who, by a letter which he wrote to him on the 10th of July 1610, invited him to quit Padua, and assigned him an ample stipend, as primate and extraordinary professor at Pisa, but without any obligation to read lectures, or to reside.

The extraordinary discoveries contained in the Nuncius Sidereus, which was immediately reprinted both in Germany and France, were the cause of much speculation and debate among the philosophers and astronomers of that time; many of whom could not be brought to give any credit to Galileo's account, while others endeavoured to decry his discoveries as being nothing more then fictions or illusions. Some could not be prevailed upon even to look through a telescope; so devoted were they to the system of Aristotle, and so averse to admit any other source of knowledge besides his writings. When it was found to be in vain to oppose the evidence of sense, some did not scruple to assert that the invention was taken from Aristotle; and producing a passage from his writings, in which he attempts to give a reason why stars are seen in the day time from the bottom of a deep well, said, that the well corresponded to the tube of the telescope, and that the vapours which arose from it gave the hint of putting glasses into it; and, lastly, that in both cases the sight is strengthened by the transmission of the rays through a thick and dark medium. Galileo himself tells this story with a great deal of humour; comparing such men to alchymists, who imagine that the art of making gold was known to the ancients, but lay concealed under the fables of the poets.

In the beginning of July of the same year, 1610, Galileo being still at Padua, and getting an imperfect view of Saturn's ring, imagined that that planet consisted of three parts; and therefore, in the account which he gave of this discovery to his friends, he calls it *planetam tergeminam*.

Whilst he was still at Padua, which must have been either in the same month of July, or the beginning of August following, he observed some spots on the face of the sun: but, contrary to his usual custom, he did not choose, at that time, to publish his discovery; partly for fear of incurring more of the hatred of many obstinate Peripatetics; and partly in order to make more exact observations on this remarkable phenomenon, and to form some conjecture concerning the probable cause of it. He therefore contented himself with communicating his observations to some of his friends at Padua and Venice, among whom we find the name of Father Paul. This delay, however, was the cause of this discovery being contested with him by the famous Scheiner, who likewise made the same observation in Oct. 1611, and we suppose had anticipated Galileo in the publication of it.

About the end of August, Galileo left Padua and went to Florence; and in November following he was satisfied, that, from the September preceding, Venus had been continually increasing in bulk, and that she changed her phases like the moon. About the end of March 1611, Galileo went to Rome, where he gratified the cardinals, and all the principal nobility, with a view of the new wonders he had discovered in the heavens, and among others the solar spots. 82

From these discoveries Galileo obtained the name of *Lynceus*, after one of the Argonauts, who was famous in antiquity for the acuteness of his sight; and moreover, the marquis of Monticelli instituted an academy, with the title of *De Lincei*, and made him a member of it. Twenty-nine years Galileo enjoyed the use of his telescope, continually enriching astronomy with his observations: but by too close an application to that instrument, and the detriment he received from the nocturnal air, his eyes grew gradually weaker, till in 1639 he became totally blind; a calamity which, however, neither broke his spirits, nor interrupted the course of his studies. Named *Lynceus* from them. 83

The first telescope that Galileo constructed magnified only three times; but presently after, he made another which magnified 18 times; and afterwards, with great trouble and expence, he constructed one that magnified 33 times; and with this it was that he discovered the satellites of Jupiter and the spots of the sun. Account of his telescopes.

Notwithstanding Galileo must be allowed to have considerable merit with respect to telescopes, it was neither that of the person who first hit upon the construction, nor that of him who thoroughly explained the *rationale* of the instrument. This important service to science was performed by John Kepler, whose name is famous on many accounts in the annals of philosophy, and especially by his discovery of the great law of motion respecting the heavenly bodies; which is, that the squares of their periodical times are as the cubes of their distances from the body about which they revolve; a proposition which, however, was not demonstrated before Sir Isaac Newton. Kepler was astronomer to several of the emperors of Germany; he was the associate of the celebrated astronomer Tycho Brahe, and the master of Descartes.

84 The *rationale* of the instrument first discovered by Kepler.

Kepler made several discoveries relating to the nature of vision; and not only explained the *rationale* of the telescope which he found in use, but also pointed out methods of constructing others of superior powers and more commodious application.

It was Kepler who first gave a clear explication of the effects of lenses, in making the rays of a pencil of light converge or diverge. He showed, that a plano-convex lens makes rays that were parallel to its axis, to meet at the distance of the diameter of the sphere of convexity; but that if both sides of the lens be equally convex, the rays will have their focus at the distance of the radius of the circle, corresponding to that degree of convexity. But he did not investigate any rule for the foci of lenses unequally convex. He only says, in general, that they will fall somewhere in the medium, between the foci belonging to the two different degrees of convexity. It is to Cavallieri that we owe this investigation. He laid down this rule: As the sum of both the diameters is to one of them, so is the other to the distance of the focus. All these rules concerning convex lenses are applicable to those that are concave; with this difference, that the focus is on the contrary side of the glass, as will be particularly shown in the second part of this treatise.

85 General reason of the effects of telescopes.

The principal effects of telescopes depend upon these plain maxims, viz. That objects appear larger in proportion to the angles which they subtend at the eye; and the effect is the same whether the pencils of rays, by which objects are visible to us, come directly from the objects themselves, or from any place nearer to the eye, where they may have been united so as to form an image of the object; because they issue again from those points where there is no real substance, in certain directions, in the same manner as they did from the corresponding points in the objects themselves.

In fact, therefore, all that is effected by a telescope is, first, to make such an image of a distant object, by means of a lens or mirror; and then to give the eye some assistance for viewing that image as near as possible: so that the angle which it shall subtend at the eye, may be very large, compared with the angle which the object itself would subtend in the same situation. This is done by means of an eye-glass, which so refracts the pencils of rays, as that they may afterwards be brought to their several foci by the natural humours of the eye. But if the eye was so formed as to be able to see the image with sufficient distinctness at the same distance without any eye-glass, it would appear to him as much magnified as it does to another person who makes use of a glass for that purpose, though he would not in all cases have so large a field of view.

If, instead of an eye-glass, an object, or the image of an object, be looked at through a small hole in a thin plate or piece of paper, held close to the eye, it may be viewed very near to the eye, and, at the same distance, the apparent magnitude of the object will be the same in both cases. For if the hole be so small as to admit but a single ray from every distinct point of the object, these rays will fall upon the retina in as many other distinct points, and make a distinct image. They are only pencils or cones of rays, which have a sensible base, as the breadth of the pupil, that are capable, by their spreading on the retina, of producing an indistinct image. As very few rays, however, can be admitted through a small hole, there will seldom be light sufficient to view any object to advantage in this manner.

If no image be actually formed by the foci of the pencils without the eye, yet if, by the help of any eye-glass, the pencils of rays shall enter the pupil, just as they would have done f[illegible] without the eye, the visual angle will be the same as if an image had actually been formed in that place. Objects will not appear inverted through this telescope, because the pencils which form the images of them, only cross one another once, *viz.* at the object glass, as in natural vision they do in the pupil of the eye.

Such is the telescope that was first discovered and used by philosophers; and it is remarkable that it should be of a much more difficult construction than some other kinds that have been invented since. The great inconvenience attending it is, that the field of view is exceedingly small. For since the pencils of rays enter the eye very much diverging from one another, but few of them can be intercepted by the pupil, this inconvenience increases with the magnifying power of the telescope; so that philosophers at this day cannot help wondering, that it was possible, with such an instrument, for Galileo and others to have made the discoveries they did. It must have required incredible patience and address. No other telescope, however, than this, was so much as thought of for many years after the discovery. Descartes, who wrote 30 years after, mentions no others as actually constructed, though Kepler had suggested some.

86 Galilean telescope more difficult of construction than others.

It is to this great man that we are indebted for the construction of what we now call the *astronomical telescope*, being the best adapted for the purpose of viewing the heavenly bodies. The *rationale* of this instrument is explained, and the advantages of it are clearly pointed out, by this philosopher, in his Catoptrics; but, what is very surprising, he never actually reduced his excellent theory into practice. Montucla conjectures, that the reason why he did not make trial of his new construction was, his not being aware of the great increase of the field of view; so that being engaged in other pursuits, he might not think it of much consequence to take any pains about the construction of an instrument, which could do little more than answer the same purpose with those of which he was already possessed. He must also have foreseen, that the length of this telescope must have been greater in proportion to its magnifying power; so that it might appear to him to be

87 Telescopes improved by Kepler.

be upon the whole not quite so good a construction as the former.

88 His method first put in practice by Scheiner.

It was not long, however, before Kepler's new scheme of a telescope was executed; and the first person who actually made an instrument of this construction was Father Scheiner, who has given a description of it in his *Rosa Ursina*, published in 1630. If, says, he, you insert two similar lenses (that is, both convex) in a tube, and place your eye at a convenient distance, you will see all terrestrial objects inverted, indeed, but magnified and very distinct, with a considerable extent of view. He afterwards subjoins an account of a telescope of a different construction, with two convex eye glasses, which again reverses the images, and makes them appear in their natural position. This disposition of the lenses had also been pointed out by Kepler, but had not been reduced to practice by him, any more than the former. This construction, however, answered the end but very imperfectly; and Father Rheita presently after hit upon a better construction, using three eye glasses instead of two. This got the name of the *terrestrial telescope*, being chiefly used for terrestrial objects.

The first and last of these constructions are those which are now in common use. The proportion in which the first telescope magnifies, is as the focal length of the object-glass to that of the eye-glass.—The only difference between the Galilean telescope and the other is, that the pencils by which the extremities of any object are seen in this case, enter the eye diverging; whereas, in the other, they enter it converging; but if the sphere of concavity in the eye-glass of the Galilean telescope be equal to the sphere of convexity in the eye-glass of another telescope, their magnifying power will be the same. The concave eye-glass, however, being placed between the object-glass and its focus, the Galilean telescope will be shorter than the other, by twice the focal length of the eye-glass. Consequently, if the length of the telescopes be the same, the Galilean will have the greater magnifying power.

89 Huygens greatly improves the telescopes of Scheiner and Rheita.

The invention of the telescope and microscope having incited mathematicians to a more careful study of dioptrics, and this having soon become almost a perfect science, by means of the discovery of Snellius, many different constructions were offered to the public. Huygens was particularly eminent for his systematic knowledge of the subject, and is the author of the chief improvements which have been made on all the dioptrical instruments till the time of Mr Dollond's discovery. He was well acquainted with the theory of aberration arising from the spherical figure of the glasses, and has showed several ingenious methods of diminishing them by proper constructions of the eye-pieces. He first showed the advantages of two eye-glasses on the astronomical telescope and double microscope, and gave rules for this construction, which both enlarges the field and shortens the instrument. Mr Dollond adapted his construction to the terrestrial telescope of De Rheita; and his five eye-glasses are nothing but the Huygenian eye-piece doubled. This construction has been too hastily given up by the artists of the present day for another, also of Mr Dollond's, of four glasses.

Vision is more distinct in the Galilean telescope than in the other, owing perhaps in part to there being no intermediate image between the eye and the object. Besides the eye-glass being very thin in the centre, the rays will be less liable to be distorted by irregularities in the substance of the glass. Whatever be the cause, we can sometimes see Jupiter's satellites very clearly in a Galilean telescope not more than twenty inches or two feet long; when one of four or five feet, of the common sort, will hardly make them visible.

90 Vision most distinct in the Galilean telescope.

91 Binocular telescope.

The same Father Rheita, to whom we are indebted for the useful construction of a telescope for land objects, invented a binocular telescope, which Father Cherubin, of Orleans, endeavoured to bring into use afterwards. It consists of two telescopes fastened together, and made to point to the same object. When this instrument is well fixed, the object appears larger, and nearer to the eye, when it is seen through both the telescopes, than through one of them only, though they have the very same magnifying power. But this is only an illusion, occasioned by the stronger impression that two equal images, equally illuminated, make upon the eye. This advantage, however, is counterbalanced by the inconvenience attending the use of it.

92 Telescopes of Campani and Divini.

The first who distinguished themselves in grinding telescopic glasses were two Italians, Eustachio Divini at Rome, and Campani at Bologna, whose fame was much superior to that of Divini, or that of any other person of his time; though Divini himself pretended, that, in all the trials that were made with their glasses, his, of a great focal distance, performed better than those of Campani, and that his rival was not willing to try them fairly, *viz.* with equal eye-glasses. It is generally supposed, however, that Campani really excelled Divini, both in the goodness and the focal length of his object-glasses. It was with telescopes made by Campani that Cassini discovered the nearest satellites of Saturn. They were made by the express order of Louis XIV. and were of 86, 100, and 136 Parisian feet focal length.

Campani sold his lenses for a great price, and took every possible method to keep his art of making them a secret. His laboratory was inaccessible to all the world, till after his death; when it was purchased by Pope Benedict XIV. who made a present of it to the academy called the *Institute*, established in that city; and by the account which M. Fougeroux has given of what he could discover from it, we learn, that (except a machine, which M. Campani constructed, to work the basons on which he ground his glasses) the goodness of his lenses depended upon the clearness of his glass, his Venetian tripoli, the paper with which he polished his glasses, and his great skill and address as a workman. It was also the general opinion at Bologna, that he owed a great part of his reputation to the secrecy and air of mystery which he affected; and that he made a great number of object-glasses which he rejected, showing only those that were very good. He made few lenses of a very great focal distance; and having the misfortune to break one of 141 feet in two pieces, he took incredible pains to join the two parts together, which he did at length effectually, so that it was used as if it had been entire; but it is not probable that he would have taken so much pains about it, if, as he pretended, he could very easily have made another as good.

Sir

Sir Paul Neille, Dr Hooke says, made telescopes of 36 feet, pretty good, and one of 50, but not of proportional goodness. Afterwards Mr Reive first, and then Mr Cox, who were the most celebrated in England as grinders of optic glasses, made some good ones of 50 and 60 feet focal distance, and Mr Cox made one of 100; but how good, Dr Hooke could not assert.

Borelli also, in France, made object glasses of a great focal length, one of which he presented to the Royal Society; but we do not find any particular account of their goodness.

93 Extraordinary object glass made by M. Auzout.

With respect to the focal length of telescopes, these and all others were far exceeded by M. Auzout, who made one object-glass of 600 feet focus; but he was never able to manage it, so as to make any use of it. Hartsocker is even said to have made some of a still greater focal length; but this ingenious mechanic, finding it impossible to make use of object-glasses the focal distance of which was much less than this, when they were enclosed in a tube, contrived a method of using them without a tube, by fixing them at the top of a tree, a high wall, or the roof a house.

94 Telescopes used without tubes.

Mr Huygens, who was also an excellent mechanic made considerable improvements in the method of using an object-glass without a tube. He placed it at the top of a very long pole, having previously enclosed it in a short tube, which was made to turn in all directions by means of a ball and socket. The axis of this tube he could command with a fine silken string, so as to bring it into a line with the axis of another short tube which he held in his hand, and which contained the eye-glass. In this method he could make use of object-glasses of the greatest magnifying power, at whatever altitude his object was, and even in the zenith, provided his pole was as long as his telescope; and to adapt it to the view of objects of different altitudes, he had a contrivance, by which he could raise or depress a stage that supported his object-glass at pleasure.

M. De la Hire, made some improvement in this method of managing the object-glass, fixing it in the centre of a board, and not in a tube; but as it is not probable that this method will ever be made use of, since the discovery of both reflecting and achromatic telescopes, which are now brought to great perfection, and have even micrometers adapted to them, we shall not describe this apparatus minutely; but shall only give a drawing of M. Huygens's pole, which, with a very short explanation, will be sufficient for the purpose. In fig. 1. *a* represents a pulley, by the help of which a stage *c, d, e, f,* (that supports the object-glass *k*, and the apparatus belonging to it), may be raised higher or lower at pleasure, the whole being counterpoised by the weight *h*, fastened to a string *g. n*, Is a weight, by means of which the centre of gravity of the apparatus belonging to the object-glass is kept in the ball and socket, so that it may be easily managed by the string *l u*, and its axis brought into a line with the eye-glass at *o*. When it was very dark, M. Huygens was obliged to make his object-glass visible by a lantern, *y*, so constructed as to throw the rays of light in a parallel direction up to it.

Plate CCLIV.

The recollection of the incredible pains which philosophers of the last age took in making observations, and the great expences they were obliged to be at for that purpose, should make us sensible of the obligations we are under to such men as Gregory, Newton, and Dollond, who have enabled us to get clearer and more satisfactory views of the remote parts of our system, with much less labour and expence; and should likewise make us more diligent and solicitous to derive all the advantages we possibly can from such capital improvements.

95 Why dioptric telescopes must be made so long.

The reason why it is necessary to make the common dioptric telescopes so very long, is, that the length of them must be increased in no less a proportion than the duplicate of the increase of their magnifying power; so that, in order to magnify twice as much as before, with the same light and distinctness, the telescope must be lengthened four times; and to magnify thrice as much, nine times; and so on.

96 Of the apertures of refracting telescopes.

Before we mention the *reflecting telescope*, it must be observed, that M. Auzout, in a paper delivered to the Royal Society, observed, that the apertures which the object-glasses of refracting telescopes can bear with distinctness, are in about a sub-duplicate proportion to their lengths; and upon this supposition he drew up a table of the apertures proper for object-glasses of a great variety of focal lengths, from 4 inches to 400 feet. Upon this occasion, however, Dr Hooke observed, that the same glass will bear a greater or less aperture, according to the less or greater light of the object. If, for instance, he was viewing the sun, or Venus, or any of the fixed stars, he used smaller apertures: but if he wanted to view the moon by daylight; or Saturn, Jupiter, or Mars, by night, he used a larger aperture.

But the merit of all these improvements was in a manner cancelled by the discovery of the much more commodious *reflecting telescope*. For a refracting telescope, even of 1000 feet focus, supposing it possible to be made use of, could not be made to magnify with distinctness more than 1000 times; whereas a reflecting telescope, not exceeding 9 or 10 feet will magnify 1200 times.

97 History of the reflecting telescope.

"It must be acknowledged (says Dr Smith in his *Complete System of Optics*), that Mr James Gregory of Aberdeen was the first inventor of the reflecting telescope; but his construction is quite different from Sir Isaac Newton's, and not nearly so advantageous."

But, according to Dr Pringle, Mersennus was the man who entertained the first thought of a reflector. A telescope with specula he certainly proposed to the celebrated Descartes many years before Gregory's invention, though indeed in a manner so very unsatisfactory, that Descartes, who had given particular attention to the improvement of the telescope, was so far from approving the proposal, that he endeavoured to convince Mersennus of its fallacy (B). Dr Smith, it

(B) *Lettres de Descartes*, Tom. II. printed at Paris in 1657, lett. 29. and 32. See this point discussed by two learned and candid authors, M. le Roy in the *Encyclopédie* under the article *Telescope*, and M. Montecula in *Hist. de Mathem.* Tom. II. p. 644.

it appears, had never peruſed the two letters of Deſcartes to Merſennus which briefly touch on that ſubject.

Again, As to his aſſertion, that Gregory's conſtruction was not nearly ſo advantageous as Newton's, it may be accounted for from his having ſet it down early in the compoſition of his work, and forgetting to qualify it afterwards, when, before the publication, he had received pretty ſure information to the contrary. Or perhaps he was influenced by the example of Dr Bradley, who had been a moſt ſucceſsful obſerver, and yet had always preferred the Newtonian teleſcope to the other. But we muſt certainly adjudge the ſuperiority to the latter, as that is now, and has been for ſeveral years paſt, the only inſtrument of the kind in requeſt.

Gregory, a young man of an uncommon genius, was led to the invention, in ſeeking to correct two imperfections of the common teleſcope: the firſt was its too great length, which made it leſs manageable; the ſecond, the incorrectneſs of the image. Mathematicians had demonſtrated, that a pencil of rays could not be collected in one point by a ſpherical lens; and alſo, that the image tranſmitted by ſuch a lens would be in ſome degree incurvated. Theſe inconveniencies he believed would be obviated by ſubſtituting for the object glaſs a metallic ſpeculum, of a parabolic figure, to receive the image, and to reflect it towards a ſmall ſpeculum of the ſame metal: this again was to return the image to an eye-glaſs placed behind the great ſpeculum, which for that purpoſe was to be perforated in its centre. This conſtruction he publiſhed in 1663, in his *Optica Promota*. But as Gregory, by his own account, was endowed with no mechanical dexterity, nor could find any workman capable of realizing his invention, after ſome fruitleſs attempts in that way he was obliged to give up the purſuit: and probably, had not ſome new diſcoveries been made in light and colours, a reflecting teleſcope would never more have been thought of, conſidering the difficulty of the execution, and the ſmall advantages that could accrue from it, deducible from the principles of optics that were then known.

But Newton, whoſe genius for experimental knowledge was equal to that for geometry, happily interpoſed, and ſaved this noble invention from well nigh periſhing in its infant ſtate. He likewiſe at an early period of life had applied himſelf to the improvement of the teleſcope; but imagining that Gregory's ſpecula were neither very neceſſary, nor likely to be executed, he began with proſecuting the views of Deſcartes, who aimed at making a more perfect image of an object, by grinding lenſes, not to the figure of a ſphere, but to that of one of the conic ſections. Now, whilſt he was thus employed, three years after Gregory's publication, he happened to take to the examination of the colours, formed by a priſm, and having by the means of that ſimple inſtrument diſcovered the different refrangibility of the rays of light, he then perceived that the errors of teleſcopes ariſing from that cauſe alone, were ſome hundred times greater than ſuch as were occaſioned by the ſpherical figure of lenſes. This circumſtance forced, as it were, Newton to fall into Gregory's track, and to turn his thoughts to reflectors. "The different refrangibility of the rays of light (ſays he, in a letter to Mr Oldenburg, ſecretary to the Royal Society, dated in Feb. 1672) made me take reflections into conſideration; and finding them regular, ſo that the angle of reflection of all ſorts of rays was equal to the angle of incidence, I underſtood that by their mediation optic inſtruments might be brought to any degree of perfection imaginable, providing a reflecting ſubſtance could be found which would poliſh as finely as glaſs, and reflect as much light as glaſs tranſmits, and the art of communicating to it a parabolic figure be alſo obtained. Amidſt theſe thoughts I was forced from Cambridge by the intervening plague, and it was more than two years before I proceeded further."

It appears, then, that if Newton was not the firſt inventor of the reflecting teleſcope, he was the main and effectual inventor. By the force of his admirable genius, he fell upon this new property of light; and thereby found, that all lenſes, of whatever figure, would be affected more or leſs with ſuch priſmatic aberrations of the rays as would be an inſuperable obſtacle to the perfection of a dioptric teleſcope.

It was towards the end of 1668, or in the beginning of the following year, when Newton being thus obliged to have recourſe to reflectors, and not relying on any artificer for making his ſpecula, ſet about the work himſelf, and early in the year 1672 completed two ſmall reflecting teleſcopes. In theſe he ground the great ſpeculum into a ſpherical concave; not but that he approved of the parabolic form propoſed by Gregory, though he found himſelf unable to accompliſh it. In the letter that accompanied one of theſe inſtruments which he preſented to the Society, he writes, "that though he then deſpaired of performing that work (to wit, the parabolic figure of the great ſpeculum) by geometrical rules, yet he doubted not but that the thing might in ſome meaſure be accompliſhed by mechanical devices."

Not leſs did the difficulty appear to find a metallic ſubſtance that would be of a proper hardneſs, have the feweſt pores, and receive the ſmootheſt poliſh; a difficulty in truth which he deemed almoſt unſurmountable, when he conſidered, that every irregularity in a reflecting ſurface would make the rays of light ſtray five or ſix times more out of their due courſe, than the like irregularities in a refracting one. In another letter, written ſoon after, he tells the ſecretary, "that he was very ſenſible that metal reflects leſs light than glaſs tranſmits; but as he had found ſome metallic ſubſtances to be more ſtrongly reflective than others, to poliſh better, and to be freer from tarniſhing than others, ſo he hoped that there might in time be found out ſome ſubſtances much freer from theſe inconveniencies than any yet known." Newton therefore laboured till he found a compoſition that anſwered in ſome degree, and left it to thoſe who ſhould come after him to find a better, and preſented a reflecting teleſcope to the Royal Society; from whom he received ſuch thanks as were due to ſo curious and ſo valuable a preſent. And Huygens, one of the greateſt geniuſes of the age, and himſelf a diſtinguiſhed improver of the refractor, no ſooner was informed by Mr Oldenburg of the diſcovery, than he wrote in anſwer, "that it was an admirable teleſcope; and that Mr Newton had well conſidered the advantage which a concave

concave ſpeculum had above convex glaſſes in collecting the parallel rays, which according to his own calculation was very great: Hence that Mr Newton could give a far greater aperture to that ſpeculum than to an object glaſs of the ſame diſtance of focus, and conſequently much more magnify in his way than by an ordinary teleſcope: Beſides, that by the reflector he avoided an inconvenience inſeparable from object glaſſes, which was the obliquity of both their ſurfaces, which vitiated the refraction of the rays that paſs towards the ſides of the glaſs, and did more hurt than men were aware of: Again, That by the mere reflection of the metalline ſpeculum there were not ſo many rays loſt as in glaſſes, which reflected a conſiderable quantity by each of their ſurfaces, and beſides intercepted many of them by the obſcurity of their matter: That the main buſineſs would be, to find a matter for this ſpeculum that would bear as good and even a poliſh as glaſs. Laſtly, He believed that Mr Newton had not been without conſidering the advantage which a parabolic ſpeculum would have over a ſpherical one in this conſtruction; but had deſpaired, as he himſelf had done, of working other ſurfaces than ſpherical ones with due exactneſs." Huygens was not ſatisfied with thus expreſſing to the ſociety his high approbation of the late invention; but drew up a favourable account of the new teleſcope, which he cauſed to be publiſhed in the *Journal des Sçavans* for the year 1672, and by that channel it was ſoon known over Europe.

But how excellent ſoever the contrivance was; how well ſoever ſupported and announced to the public; yet whether it was that the artiſts were deterred by the difficulty and labour of the work, or that the diſcoveries even of a Newton were not to be exempted from the general fatality attending great and uſeful inventions, *the making a ſlow and vexatious progreſs to the authors;* the fact is, that, excepting an unſucceſsful attempt which the ſociety made, by employing an artificer to imitate the Newtonian conſtruction, but upon a larger ſcale, and a diſguiſed Gregorian teleſcope, ſet up by Caſſegrain abroad as a rival to Newton's, and that in theory only (for it was never put in execution by the author), no reflector was heard of for nearly half a century after. But when that period was elapſed, a reflecting teleſcope was at laſt produced to the world of the Newtonian conſtruction by Dr Hadley, which the author had the ſatisfaction to find executed in ſuch a manner as left no room to fear that the invention would any longer continue in obſcurity.

This memorable event was owing to the genius, dexterity, and application, of Mr Hadley the inventor of the reflecting quadrant, another moſt valuable inſtrument. The two teleſcopes which Newton had made were but ſix inches long, were held in the hand for viewing objects, and in power were compared to a ſix feet refractor; whereas Hadley's was above five feet long, was provided with a well-contrived apparatus for managing it, and equalled in performance the famous aërial teleſcope of Huygens of 123 feet in length. Excepting as to the manner of making the ſpecula, we have, in the Tranſactions of 1723, a complete deſcription, with a figure, of this teleſcope, together with that of the machine for moving it; but, by a ſtrange omiſſion, Newton's name is not once mentioned in that paper, ſo that any perſon not acquainted with the hiſtory of the invention, and reading that account only, might be apt to conclude that Hadley had been the ſole contriver of it.

The ſame celebrated artiſt, after finiſhing two teleſcopes of the Newtonian conſtruction, accompliſhed a third in the Gregorian way; but, it would ſeem, leſs ſucceſsfully, by Dr Smith's declaring ſo ſtrongly in favour of the other. Mr Hadley ſpared no pains to inſtruct Mr Molyneux and the reverend Dr Bradley; and when thoſe gentlemen had made a ſufficient proficiency in the art, being deſirous that theſe teleſcopes ſhould become more public, they liberally communicated to ſome of the principal inſtrument makers of London the knowledge they had acquired from him. Now ſuch ſcholars, as it is eaſy to imagine, ſoon advanced beyond their maſters, and completed reflectors by other and better methods than what had been taught them.

Certain it is, at leaſt, that Mr James Short, as early as the year 1734, had ſig[illegible] himſelf at Edinburgh by his work of this kind. Mr Maclaurin wrote that year to Dr Jurin, "that Mr Short, who had begun with making glaſs ſpecula, was then applying himſelf to improve the metallic; and that, by taking care of the figure, he was enabled to give them larger apertures than others had done; and that upon the whole they ſurpaſſed in perfection all that he had ſeen of other workmen." He added, "that Mr Short's teleſcopes were all of the Gregorian conſtruction; and that he had much improved that excellent invention." This character of excellence Mr Short maintained to the laſt; and with the more facility, as he had been well grounded both in the geometrical and philoſophical principles of optics, and upon the whole was a moſt intelligent perſon in whatever related to his profeſſion. It was ſuppoſed he had fallen upon a method of giving the parabolic figure to his great ſpeculum; a point of perfection that Gregory and Newton had wiſhed for, but deſpaired of attaining; and that Hadley had never, as far as we know, attempted, either in his Newtonian or Gregorian teleſcope. Mr Short indeed ſaid he had acquired that faculty, but never would tell by what peculiar means he effected it; ſo that the ſecret of working that configuration, whatever it was, as far as it then appeared, died with that ingenious artiſt. Mr Mudge, however, hath lately realized the expectation of Sir Iſaac Newton, who, above 100 years ago, preſaged that the public would one day poſſeſs a parabolic ſpeculum, not accompliſhed by mathematical rules, but by mechanical devices.

This was a *deſideratum*, but it was not the only want ſupplied by this gentleman: he has taught us likewiſe a better compoſition of metals for the ſpecula, how to grind them better, and how to give them a finer poliſh; and this laſt part (namely, the poliſh), he remarks, was the moſt difficult and eſſential of the whole operation. "In a word (ſays Sir John Pringle), I am of opinion, there is no optician in this great city (which hath been ſo long and ſo juſtly renowned for ingenious and dexterous makers of every kind of mathematical inſtruments) ſo partial to his own abilities

as not to acknowledge, that, however some parts of the mechanical process now disclosed might have been known before by individuals of the profession, yet that Mr Mudge hath opened to them all some new and important lights, and upon the whole hath greatly improved the art of making reflecting telescopes."

98 Mr Edwards's improvements of the reflecting telescope.

The late reverend and ingenious John Edwards devoted much of his time to the improvement of reflecting telescopes, and brought them to such perfection, that Dr Maskelyne, the astronomer royal, found telescopes constructed by him to surpass in brightness, and other essentials, those of the same size made by the best artists in London. The chief excellence of his telescopes arises from the composition, which, from various trials on metals and semimetals, he discovered for the specula, and from the true parabolic figure, which, by long practice, he had found a method of giving them, preferable to any that was known before him. His directions for the composition of specula, and for casting, grinding, and polishing them, were published, by order of the commissioners of longitude, at the end of the Nautical Almanack for the year 1787. To the same almanack is also annexed his account of the cause and cure of the tremors which particularly affect reflecting telescopes more than refracting one, together with remarks on the said tremors by Dr Maskelyne. See TELESCOPE.

99 Herschel's improvements.

But in constructing reflecting telescopes of extraordinary magnifying powers, Dr Herschel has displayed skill and ingenuity surpassing all his predecessors in this department of mechanics. He has made them from 7, 10, 20, to even 40 feet in length; and with the instrument of these latter dimensions he is now employed in making discoveries in astronomy. Of its construction, magnifying powers, and the curious collection of machinery by which it is supported and moved from one part of the heavens to another, accounts will be given under the word TELESCOPE.

The greatest improvement in *refracting* telescopes hitherto made public (c) is that of Mr Dollond, of which an account has already been given in a preceding section, wherein his discoveries in the science of optics were explained. But, besides the obligation we are under to him for correcting the aberration of the rays of light in the focus of object-glasses, arising from their different refrangibility, he made another considerable improvement in telescopes, viz. by correcting, in a great measure, both this kind of aberration, and also that which arises from the spherical form of lenses by an expedient of a very different nature; viz. increasing the number of eye-glasses.

100 Account of Mr Dollond's improvements

If any person, says he, would have the visual angle of a telescope to contain 20 degrees, the extreme pencils of the field must be bent or refracted in an angle of 10 degrees; which, if it be performed by one eye-glass, will cause an aberration from the figure, in proportion to the cube of that angle; but if two glasses are so proportioned and situated, as that the refraction may be equally divided between them, they will each of them produce a refraction equal to half the required angle; and therefore, the aberration being in proportion to the cube of half the angle taken twice over, will be but a fourth part of that which is in proportion to the cube of the whole angle; because twice the cube of 1 is but $\frac{1}{4}$ of the cube of 2; so the aberration from the figure, where two eye-glasses are rightly proportioned, is but a fourth of what it must unavoidably be, where the whole is performed by a single eye-glass. By the same way of reasoning, when the refraction is divided between three glasses, the aberration will be found to be but the ninth part of what would be produced from a single glass; because three times the cube of 1 is but one-ninth of the cube of 3. Whence it appears, that by increasing the number of eye-glasses, the indistinctness which is observed near the borders of the field of a telescope may be very much diminished, though not entirely taken away.

The method of correcting the errors arising from the different refrangibility of light is of a different consideration from the former. For, whereas the errors from the figure can only be diminished in a certain proportion according to the number of glasses, in this they may be entirely corrected by the addition of only one glass; as we find in the astronomical telescope, that two eye-glasses, rightly proportioned, will cause the edges of objects to appear free from colours, quite to the borders of the field. Also in the day telescope, where no more than two eye-glasses are absolutely necessary for erecting the object, we find, that by the addition of a third, rightly situated, the colours, which would otherwise make the image confused, are entirely removed. This, however, is to be understood with some limitation: for though the different colours into which the extreme pencils must necessarily be divided by the edges of the eye-glasses, may in this manner be brought to the eye in a direction parallel to each other, so as, by the humours of the eye, to be made to converge to a point on the retina; yet, if the glasses exceed a certain length, the colours may be spread too wide to be capable of being admitted through the pupil or aperture of the eye; which is the reason, that in long telescopes, constructed in the common manner, with three eye-glasses, the field is always very much contracted.

These considerations first set Mr Dollond on contriving how to enlarge the field, by increasing the number of eye-glasses without any hinderance to the distinctness or brightness of the image; and though others had been about the same work before, yet, observing that some five-glass telescopes which were then made would admit of farther improvement, he endeavoured to construct one with the same number of glasses in a



(c) Dr Blair's discovery, mentioned N° 19. will undoubtedly lead to improvements superior to those of Dollond; but as his memoir on the subject is not yet published, we feel not ourselves at liberty to make longer extracts from it. The reader will see the whole in the Philosophical Transactions of the Royal Society of Edinburgh, whenever that body shall be pleased to favour the public with a third volume of [illegible] ained labours.

better manner; which so far answered his expectations, as to be allowed by the best judges to be a considerable improvement on the former.

Encouraged by this success, he resolved to try if he could not make some farther enlargement of the field, by the addition of another glass, and by placing and proportioning the glasses in such a manner as to correct the aberrations as much as possible, without any detriment to the distinctness: and at last he obtained as large a field as is convenient or necessary, and that even in the longest telescopes that can be made.

These telescopes with six glasses having been well received, and some of them being gone into foreign parts, it seemed a proper time to the author to settle the date of his invention; on which account he drew up a letter, which he addressed to Mr Short, and which was read at the Royal Society, March 1. 1753 (D).

101 Mr Smith's proposal to shorten telescopes. Various other attempts were made about this time to shorten and otherwise improve telescopes. Among these we may just mention that of Mr Caleb Smith, who, after giving much attention to the subject, thought that he had found it possible to rectify the errors which arise from the different degrees of refrangibility, on the principle that their sines of refraction, or rays differently refrangible, are to one another in a given proportion, when their sines of incidence are equal; and the method which he proposed for this purpose was to make the speculums of glass instead of metal, the two surfaces having different degrees of concavity. But we do not find that this scheme was ever executed: nor is it probable, for reasons which have been mentioned, that any advantage could be made of it.

102 Equatorial telescope, or portable observatory. To Mr Short we are indebted for the excellent contrivance of an equatorial telescope, or, as he likewise called it, a *portable observatory*: for with it pretty accurate observations may be made with very little trouble, by those who have no building adapted to the purpose. The instrument consists of an ingenious piece of machinery, by the help of which a telescope mounted upon it may be directed to any degree of right ascension or declination, so that the place of any of the heavenly bodies being known, they may be found without any trouble, even in the day time. Also, being made to turn parallel to the equator, any object is easily kept in view, or recovered, without moving the eye from its situation. By this instrument, Mr Short informs us, that most of the stars of the first and second magnitude have been seen even at mid day, and the sun shining bright; as also Mercury, Venus, and Jupiter. Saturn and Mars are not so easy to be seen, on account of the faintness of their light, except when the sun is but a few hours above the horizon. This particular effect depends upon the telescope excluding almost all the light, except what comes from the object itself, and which might otherwise efface the impression made by its weaker light upon the eye. Any telescope of the same magnifying power would have the same effect, could we be sure of pointing it right. For the same reason, also, it is that stars are visible in the day time from the bottom of a deep pit. Mr Ramsden has lately invented a *portable observatory* or *equatorial telescope*, which may perhaps supersede the use of Mr Short's. See ASTRONOMY, N° 504.

103 How to observe the stars in the day time. In order to enable us to see the fixed stars in the day time, it is necessary to exclude the extraneous light as much as possible. For this reason the greater the magnifying power of any telescope is used, the more easily a fixed star will be distinguished in the day time; the light of the star remaining the same in all magnifying powers of the same telescope, but the ground upon which it is seen becoming darker by increasing the magnifying power; and the visibility of a star depends very much upon the difference between its own light and that of the ground upon which it is seen. A fixed star will be very nearly equally visible with telescopes of very different apertures, provided the magnifying power remains the same.

If a comet, or any other heavenly body, be viewed through this equatorial telescope, properly rectified, it is seen immediately by the help of the same machinery what is its true place in the heavens. Other astronomical problems may also be solved by it, with great ease and certainty.

104 Mr Æpinus's proposal for bending the tubes of telescopes. M. Æpinus proposes to bend the tubes of long telescopes at right angles, fixing a plane mirror in the angle, in order to make them more commodious for viewing objects near the zenith of the observer; and he gives particular instructions how to make them in this form, especially when they are furnished with micrometers. We are also informed that a little plane speculum is sometimes placed betwixt the last eye-glass and the eye in the reflecting telescopes, at an angle of 45°, for the same purpose.

105 History of Microscopes. THE invention of MICROSCOPES was not much later than that of telescopes; and, according to Borellus, whose account we do not find to have been called in question by any person, we are indebted for them to the same author, at least to Z. Jansen, in conjunction with his son; and for this latter favour, we may perhaps, be considered as under more obligation to them than for the former, the microscope having more various and extensive uses, with respect to philosophy, than the telescope. In our ideas, however, it appears something greater, and more extraordinary, to be able to see objects too distant to be perceived by the naked eye; than those that are too near to be seen by us; and therefore there is more of the sublime in the telescope than the microscope. These two instruments, though different in their application, are notwithstanding very similar; as both of them assist us in the discovery of objects that we must otherwise have remained unacquainted with, by enlarging the angle which they subtend at the eye.

The Jansens, however, have not always enjoyed, undisturbed, that share of reputation to which they seem to be entitled, with respect either to the telescope or the microscope. The discovery of the latter, in particular, has generally been considered as more uncertain than that of the former. All that many writers say we can depend upon is, that microscopes were first used in Germany about the year 1621. Others say positively, that this instrument was the contrivance of Cornelius

(D) This paragraph is extracted from this paper in the Transactions; but Dollond's improvement there described is not accompanied by any diagram. For a minute account of it, and of eye-pieces in general, see *Ludlam's Essays*.

Cornelius Drebell, no philofopher, but a man of curiofity and ingenuity, who alfo invented the thermometer.

According to Borellus, Zacharias Janfen and his fon prefented the firft microfcopes they had conftructed to Prince Maurice, and Albert archduke of Auftria. William Borell, who gives this account in a letter, to his brother Peter, fays, that when he was ambaffador in England, in 1619, Cornelius Drebell, with whom he was intimately acquainted, fhowed him a microfcope, which he faid was the fame the archduke had given him, and had been made by Janfen himfelf. This inftrument was not fo fhort as they are generally made at prefent, but was fix feet long, confifting of a tube of gilt copper, an inch in diameter, fupported by three brafs pillars in the fhape of dolphins, on a bafe of ebony,' on which the fmall objects were placed.

106 Microfcope made by Janfen.

This microfcope was evidently a compound one, or rather fomething betwixt a telefcope and a microfcope, what we fhould now, perhaps choofe to call a *megalafcope*; fo that it is poffible that fingle microfcopes might have been known, and in ufe, fome time before; but perhaps nobody thought of giving that name to fingle lenfes; though, from the firft ufe of lenfes, they could not but have been ufed for the purpofe of magnifying fmall objects. In this fenfe we have feen, that even the ancients were in poffeffion of microfcopes; and it appears from Jamblicus and Plutarch, quoted by Dr Rogers, that they gave fuch inftruments as they ufed for this purpofe the name of *dioptra*. As fpectacles were certainly in ufe long before the invention of telefcopes, one can hardly help concluding, that lenfes muft have been made fmaller, and more convex, for the purpofe of magnifying minute objects; efpecially as the application of this kind of microfcope was nearly the fame with that of a fpectacle glafs, both of them being held clofe to the eye. At what time lenfes were made fo fmall as we now generally ufe them for magnifying in fingle microfcopes, we have not found. But as this muft neceffarily have been done gradually, the only proper object of inquiry is the invention of the double or compound microfcope; and this is clearly given, by the evidence of Borellus above-mentioned, to Zacharias Janfen the inventor of the telefcope, or his fon.

The invention of compound microfcopes is claimed by the fame Fontana who claimed the difcovery of telefcopes; and though he did not publifh any account of this invention till the year 1646 (notwithftanding he pretended to have made the difcovery in 1618), Montucla, not having attended perhaps to the teftimony of Borellus, is willing to allow his claim, as he thought there was no other perfon who feemed to have any better right to it.

107 By Divini.

Euftachio Divini made microfcopes with two common object-glaffes, and two plano-convex eye-glaffes joined together on their convex fides fo as to meet in a point. The tube in which they were enclofed was as big as a man's leg, and the eye-glaffes almoft as broad as the palm of a man's hand. Mr Oldenburg, fecretary to the Royal Society, received an account of this inftrument from Rome, and read it at one of their meetings, Auguft 6. 1668.

108 By Hartfocker.

It was in this period that Hartfocker improved fingle microfcopes, by ufing fmall globules of glafs, made by melting them in the flame of a candle, inftead of the lenfes which had before been made ufe of for that purpofe. By this means he firft difcovered the *animalcula in femine mafculino*, which gave rife to a new fyftem of generation. A microfcope of this kind, confifting of a globule of an inch $\frac{1}{10}$ in diameter, M. Huygens demonftrated to magnify 100 times; and fince it is eafy to make them of lefs than half a line in diameter, they may be made to magnify 300 times. Were it not for the difficulty of applying objects to thefe magnifiers, the want of light, and the fmall field of diftinct vifion, they would certainly have been the moft perfect of all microfcopes.

109 By Leeuwenhoek.

But no man diftinguifhed himfelf fo much by microfcopical difcoveries as the famous M. Leeuwenhoek, though he ufed only fingle lenfes with fhort foci, preferring diftinctnefs of vifion to a large magnifying power.

M. Leeuwenhoek's microfcopes were all fingle ones, each of them confifting of a fmall double convex glafs, fet in a focket between two filver plates rivetted together, and pierced with a fmall hole; and the object was placed on the point of a needle, fo contrived as to be placed at any diftance from the lens. If the objects were folid, he faftened them with glue; and if they were fluid, or on other accounts required to be fpread upon glafs, he placed them on a fmall piece of Mufcovy talc, or glafs blown very thin; which he afterwards glued to his needle. He had, however, a different apparatus for viewing the circulation of the blood, which he could fix to the fame microfcopes.

The greateft part of his microfcopes M. Leeuwenhoek bequeathed to the Royal Society. They were contained in a fmall Indian cabinet, in the drawers of which were 13 little boxes, or cafes, in each of which were two microfcopes, neatly fitted up in filver; and both the glafs and the apparatus were made with his own hands.

The glafs of all thefe lenfes is exceedingly clear, but none of them magnifies fo much as thofe globules which are frequently ufed in other microfcopes; but Mr Folkes, who examined them, thought that they fhowed objects with much greater diftinctnefs, which M. Leeuwenhoek principally valued. His difcoveries, however, are to be afcribed not fo much to the goodnefs of his glaffes, as to his great judgment, acquired by long experience, in ufing them. He alfo particularly excelled in his manner of preparing objects for being viewed to the moft advantage.

Mr Baker, who alfo examined M. Leeuwenhoek's microfcopes, and made a report concerning them to the Royal Society, found that the greateft magnifier among them enlarged the diameter of an object about 160 times, but that all the reft fell much fhort of that power; fo he concluded that M. Leeuwenhoek muft have had other microfcopes of a much greater magnifying power for many of his difcoveries. And it appears, he fays, by many circumftances, that he had fuch microfcopes.

It appears from M. Leeuwenhoek's writings, that he was not unacquainted with the method of viewing opaque objects by means of a fmall concave reflecting mirror, which was afterwards improved by M. Lieberkuhn. For, after defcribing his apparatus for viewing eels in glafs tubes, he adds, that he had an inftrument to which he fcrewed a microfcope fet in brafs, upon

upon which microscope he fastened a little dish of brass, probably that his eye might be thereby assisted to see objects better; for he says he had filed the brass which was round his microscope as bright as he could, that the light, while he was viewing objects, might be reflected from it as much as possible. This microscope, with its dish, is constructed upon principles so similar to those which are the foundation of our single microscope by reflection (see MICROSCOPE), that it may well be supposed to have given the hint to the ingenious inventor of it, provided he ever attended to it.

110 Wilson's microscope.

In 1702, Mr Wilson made several ingenious improvements in the method of using single magnifiers, for the purpose of viewing transparent objects; and his microscope, which is also a necessary part of the solar microscope, is in very general use at this day. (See MICROSCOPE, sect. 1.)

111 Adams's method of making globules for large magnifiers.

In 1710, Mr Adams gave to the Royal Society the following account of his method of making small globules for large magnifiers. He took a piece of fine window-glass, and cut it with a diamond into as many lengths as he thought proper, not exceeding $\frac{1}{8}$ of an inch in breadth; then, holding one of them between the fore-finger and thumb of each hand over a very fine flame, till the glass began to soften, he drew it out till it was as fine as a hair, and broke; then putting each of the ends into the purest part of the flame, he had two globules presently, which he could make larger or less at pleasure. If they were held a long time in the flame, they would have spots in them, so that he drew them out presently after they became round. The stem he broke off as near to the globule as he could, and lodging the remainder between the plates, in which holes were drilled exactly round, the microscope, he says, performed to admiration. Through these magnifiers, he says, that the same thread of very fine muslin appeared three or four times bigger than it did in the largest of Mr Wilson's magnifiers.

112 Temporary microscopes by Mr Grey.

The ingenious Mr Grey hit upon a very easy expedient to make very good temporary microscopes, at a very little expence. They consist of nothing but very small drops of water, taken up with the point of a pin, and put into a small hole made in a piece of metal. Those globules of water, do not, indeed, magnify so much as those which are made of glass of the same size, because the refractive power of water is not so great; but the same purpose will be answered nearly as well by making them somewhat smaller.

The same ingenious person, observing that small heterogeneous particles enclosed in the glass of which microscopes are made, were much magnified when those glasses were looked through, thought of making his microscopes of water that contained living animalcula, to see how they would look in this new situation; and he found his scheme to answer even beyond his utmost expectation, so that he could not even account for their being magnified so much as they were: for it was much more than they would have been magnified if they had been placed beyond the globule, in the proper place for viewing objects. But Montucla observes, that, when any object is enclosed within this small transparent globule, the hinder part of it acts like a concave mirror, provided they be situated between that surface and the focus; and that, by this means, they are magnified above $3\frac{1}{2}$ times more than they would have been in the usual way.

113 Dr Barker's reflecting microscope.

After the happy execution of the reflecting telescope, it was natural to expect that attempts would also be made to render a similar service to microscopes. Accordingly we find two plans of this kind. The first was that of Dr Robert Barker. His instrument differs in nothing from the reflecting telescope, excepting the distance of the two speculums, in order to adapt it to those pencils of rays which enter the microscope diverging; whereas they come to the telescope from very distant objects nearly parallel to each other.

This microscope is not so easy to manage as the common sort. For vision by reflection, as it is much more perfect, so it is far more difficult than that by refraction. Nor is this microscope so useful for any but very small or transparent objects. For the object, being between the speculum and image, would, if it were large and opaque, prevent a due reflection.

114 Dr Smith's reflecting microscope superior to all others.

Dr Smith invented a double reflecting microscope, of which a theoretical and practical account is given in the remarks on the second volume of his System of Optics. Through some of those incidents to which the conducting of a work so multifarious as ours is always liable, this instrument was omitted under the article MICROSCOPE. As it is constructed on principles essentially different from all others, and, in the opinion of the ablest judges whom we have consulted, incomparably superior to them all, the reader will not be ill pleased with the following practical description, though it appears not perhaps in its most proper place.

Plate CCCLIV.

Fig. 2. is a section of this microscope, where ABC and *abc* are two specula, the former concave, and the latter convex, enclosed within the tube DEFG. The speculum ABC, is perforated like the speculum of a Gregorian telescope; and the object to be magnified is so placed between the centre and principal focus of that speculum, that the rays flowing from it to ABC are reflected towards an image *pq*. But before they are united in that image they are received by the convex speculum *abc*, and thence reflected through the hole BC in the vertex of the concave to a second image $\pi\kappa$, to be viewed through an eye-glass *l*. The object may either be situated between the two specula, or, which is perhaps better, between the principal focus and vertex *c* of the convex speculum *abc*, a small hole being made in its vertex for the incident rays to pass through. When the microscope is used, let the object be included between two little round plates of Muscovy glass, fixed in a hole of an oblong brass plate *mn*, intended to slide close to the back side of the convex speculum: which must therefore be ground flat on that side, and so thin that the object may come precisely to its computed distance from the vertex of the speculum. The slider must be kept tight to the back of the metal by a gentle spring. The distance of the object being thus determined once for all, distinct vision to different eyes, and through different eye-glasses, must be procured by a gentle motion of the little tubes that contain these glasses. These tubes must be made in the usual form of those that belong to Sir Isaac Newton's reflecting telescope, (see TELESCOPE), having a small hole in the middle of each plate, at the ends of the tube, situated exactly in each focus of the glass;

glass; the use of these holes and plates is to limit the visible area, and hinder any straggling rays from entering the eye. To the tube of the eye-glass is fastened the arm *g*, on which the adjusting screw turns. A similar arm *u* is attached to the fixed tube X, in which the neck of the screw turns; and by turning the button *y*, the eye tube is moved farther from or nearer to the object, by which means different sorts of eyes obtain distinct vision.

The rays which flow from the object directly through the hole in the concave speculum and through the eye-glass, by mixing with the reflected rays, would dilute the image on the retina, and therefore must be intercepted. This is done by a very simple contrivance. The little hole in the convex speculum is ground conical as in the figure; and a conical solid P, of which the base is larger than the orifice in the back of the convex speculum, supported on the slender pillar PQ, is so placed as to intercept all the *direct rays*, from the eye-glass. All the tubes are strongly blacked on their insides, and so is the conical solid, to hinder all reflection of rays from these objects upon the convex speculum. The little base, of the solid should be made concave, that whatever light it may still reflect, may be thrown back upon the object; and its backside being conical and blacked all over, will either absorb or laterally disperse any straggling rays which the concave speculum may scatter upon it, and so prevent their coming to the eye-glass.

Notwithstanding the interposition of this conical solid, yet when the eye-glass is taken out, distant objects may be distinctly seen through the microscope, by rays reflected from the metals, and diverging upon the eye from an image behind the convex speculum. But this mixture of foreign rays with those of the object, which is common to all kinds of microscopes in viewing transparent objects, is usually prevented by placing before the object a thick double convex lens L, to collect the sky light exactly from the object. This lens should be just so broad as to subtend the opposite angle to that which the concave speculum subtends at the object. The annular frame of the lens must be very narrow, and connected to the microscope by two or three slender wires or blades, whose planes produced may pass through the object, and intercept from it as little sky light as possible.

This is not the place for explaining the principles of this microscope, or demonstrating its superiority over most others; nor are such explanation and demonstration necessary. Its excellence, as well as the principles upon which it is constructed, will be perceived by the reader, when he has made himself master of the laws of refraction and reflection as laid down in the ensuing part of this article.

115 Solar microscope, and that for opaque objects.

In 1738 or 1739, M. Lieberkuhn made two capital improvements in microscopes, by the invention of the *solar microscope*, and the *microscope for opaque objects*. When he was in England in the winter of 1739, he showed an apparatus of his own making, for each of these purposes, to several gentlemen of the Royal Society, as well as to some opticians, particularly Mr Cuff in Fleet-street, who took great pains to improve them.

The microscope for opaque objects remedies the inconvenience of having the dark side of an object next the eye. For by means of a concave speculum of silver, highly polished, in the centre of which a magnifying lens is placed, the object is so strongly illuminated that it may be examined with all imaginable ease and pleasure. A convenient apparatus of this kind, with four different speculums and magnifiers of different powers, was brought to perfection by Mr Cuff.

M. Lieberkuhn made considerable improvements in his solar microscope, particularly in adapting it to the view of opaque objects; but in what manner this end was effected, M. Æpinus, who was highly entertained with the performance, and who mentions the fact, was not able to recollect; and the death of the ingenious inventor prevented his publishing any account of it himself. M. Æpinus invites those persons who came into the possession of M. Lieberkuhn's apparatus to publish an account of this instrument; but it doth not appear that his method was ever published.

This improvement of M. Lieberkuhn's induced M. Æpinus himself to attend to the subject; and by this means he produced a very valuable improvement in this instrument. For by throwing the light upon the foreside of any object by means of a mirror, before it is transmitted through the object lens, all kinds of objects are equally well represented by it.

116 Reflected light introduced into the microscope and magic lantern.

M. Euler proposed a scheme to introduce vision by reflected light into the magic lantern and solar microscope, by which many inconveniences to which those instruments are subject might be avoided. For this purpose, he says, that nothing is necessary but a large concave mirror, perforated as for a telescope; and that the light be so situated, that none of it may pass directly through the perforation, so as to fall on the images of the objects upon the screen. He proposes to have four different machines, for objects of different sizes; the first for those of six feet long, the second for those of one foot, the third for those of two inches, and the fourth for those of two lines; but it is needless to be particular in the description of these, as more perfect instruments are described under the article MICROSCOPE.

Several improvements were made in the apparatus to the solar microscope, as adapted to view opaque objects, by M. Zeiher, who made one construction for the larger kind of objects, and another for the small ones.

117 Mr Martin's improvement in the solar microscope.

Mr Martin having constructed a solar microscope of a larger size than common, for his own use, the illuminating lens being $4\frac{1}{2}$ inches in diameter, and all the other parts of the instrument in proportion, found, that by the help of an additional part, which he does not describe, he could see even opaque objects very well. If he had made the lens any larger, he was aware that the heat produced at the focus would have been too great for the generality of objects to bear. The expence of this instrument, he says, does not much exceed the price of the common solar microscope.

118 Di Torre's extraordinary magnifying microscope.

The smallest globules, and consequently the greatest magnifiers, for microscopes, that have yet been executed, were made by T. Di Torre of Naples, who, in 1765, sent four of them to the Royal Society. The largest of them was only two Paris points in diameter, and it was said to magnify the diameter of an object 640 times. The second was the size of one Paris point, and

and the third was no more than half of a Paris point, or the 144th part of an inch in diameter, and was said to magnify the diameter of an object 2560 times. One of these globules was wanting when they came into the hands of Mr Baker, to whose examination they were referred by the Royal Society. This gentleman, so famous for his skill in microscopes, and his extraordinary expertness in managing them, was not able to make any use of these. With that which magnifies the least, he was not able to see any object with satisfaction; and he concludes his account with expressing his hopes only, that, as his eyes had been much used to microscopes, they were not injured by the attention he had given to them, though he believed there were few persons who would not have been blinded by it.

119 Could not be used by Mr Baker.

The construction of a telescope with six eye-glasses led M. Euler to a similar construction of microscopes, by introducing into them six lenses, one of which admits of so small an aperture, as to serve, instead of a diaphragm, to exclude all foreign light, though, as he says, it neither lessens the field of view, nor the brightness of objects.

120 Difficulties attending the construction of dioptric instruments.

The improvement of all dioptric instruments is greatly impeded by inequalities in the substance of the glass of which they are made; but though many attempts have been made to make glass without that imperfection, none of them have been hitherto quite effectual. M. A. D. Merklein, having found some glass which had been melted when a building was on fire, and which proved to make excellent object-glasses for telescopes, concluded that its peculiar goodness arose from its not having been disturbed when it was in a fluid state; and therefore he proposed to take the metal out of the furnace in iron vessels, of the same form that was wanted for the glass; and after it had been perfectly fluid in those vessels, to let it stand to cool, without any disturbance. But this is not always found to answer.

# PART I. THEORY OF OPTICS.

This part of the science contains all that hath been discovered concerning the various motions of the rays of light, either through different mediums, or when reflected from different substances in the same medium. It contains also the *rationale* of every thing which hath been discovered with regard to vision; the optical deceptions to which we are liable; and, in short, ought to give the reason of all the known optical phenomena.—The science is commonly divided into three parts, viz. Dioptrics, which contain the laws of refraction, and the phenomena depending upon them; Catoptrics, which contain the laws of reflection, and the phenomena which depend on them; and, lastly, Chromatics, which treat of the phenomena of colour. But this definition is of no use in a treatise of Optics, as most of the phenomena depend both on refraction and reflection, colour itself not excepted. For this reason, though we have given detached articles under the words Dioptrics, Catoprics, and Chromatics; we have reserved to this place the explanation of the laws of reflection and refraction, by which all optical phenomena may be accounted for.

## Sect. I. *Of the properties of Light in general.*

Under the article Light we have given some account of the controversies concerning its nature. The opinions of philosophers may, in general, be arranged under these two: 1. That the phenomena of vision and illumination are produced by the undulations of an elastic fluid, much in the same manner as sound is produced by the undulations of air. This opinion was first offered to the public by Descartes, and afterwards by Mr Huygens, and has lately been revived by M. Euler, who has endeavoured to explain the phenomena upon mechanical principles.—2. That the phenomena of vision are produced by the motion and action of matter emitted from the shining body with immense velocity, moving uniformly in straight lines, and acted on by other bodies; so as to be reflected, refracted, or inflected, in various ways, by means of forces which act on it in the same manner as on other inert matter. Sir Isaac Newton has shown, in the most incontrovertible manner, the total dissimilarity between the phenomena of vision and the legitimate consequences of the undulations of an elastic fluid. All M. Euler's ingenious and laborious discussions have not removed Newton's objections in the smallest degree. Sir Isaac adopts the vulgar opinion, therefore, making light of the difficulties objected to it, because none of them are inconsistent with the established principles of mechanics, and are merely difficulties of conception to limited faculties like ours. We need not despair of being able to decide, by experiment, which of these opinions is nearest to the truth; because there are phenomena where the result should be sensibly different in the two hypotheses. At present, we shall content ourselves with giving some account of the legitimate consequences of the vulgar opinion as modified by Sir Isaac Newton, viz. that light consists of small particles emitted with very great velocity, and attracted or repelled by other bodies at very small distances.

121 Different opinions concerning the nature of light.

Every visible body emits or reflects inconceivably small particles of matter from each point of its surface, which issue from it continually (not unlike sparks from a coal) in straight lines and in all directions. These particles entering the eye, and striking upon the retina, (a nerve expanded on the back part of the eye to receive their impulses), excite in our minds the idea of light. And as they differ in substance, density, velocity, or magnitude, they produce in us the ideas of different colours; as will be explained in its proper place.

122 Light issues in straight lines from each point in a luminous surface.

That the particles which constitute light are exceedingly small, appears from hence, viz. that if a hole be made through a piece of paper with a needle, rays of light from every object on the farther side of it are capable of passing through it at once without the least confusion; for any one of those objects may as clearly be seen through it, as if no rays passed through it from any of the rest. Further, If a candle is lighted, and there be no obstacle in the way to obstruct the progress

grefs of its rays, it will fill all the fpace within two miles of it every way with luminous particles, before it has loft the leaft fenfible part of its fubftance thereby.

That thefe particles proceed from every point of the furface of a vifible body, and in all directions, is clear from hence, *viz.* becaufe wherever a fpectator is placed with regard to the body, every point of that part of the furface which is turned towards him is vifible to him. That they proceed from the body in right lines, we are affured, becaufe juft fo many and no more will be intercepted in their paffage to any place by an interpofed object, as that object ought to intercept, fuppofing them to come in fuch lines.

The velocity with which they proceed from the furface of the vifible body is no lefs furprifing than their minutenefs; the method whereby philofophers eftimate their fwiftnefs, is by obfervations made on the eclipfes of Jupiter's fatellites; which eclipfes appear to us about feven minutes fooner than they ought to do by calculation, when the earth is placed between the fun and him, that is, when we are neareft to him; and as much later, when the fun is between him and us, at which time we are fartheft from him; from whence it is concluded, that they require about feven minutes to pafs over a fpace equal to the diftance between the fun and us, which is about 95,000,000 of miles.

A ftream of thefe particles iffuing from the furface of a vifible body in one and the fame direction, is called a *ray of light*.

As rays proceed from a vifible body in all directions, they neceffarily become thinner and thinner, continually fpreading themfelves as they pafs along into a larger fpace, and that in proportion to the fquares of their diftances from the body; that is, at the diftance of two fpaces, they are four times thinner than they are at one; at the diftance of three fpaces, nine times thinner, and fo on; the reafon of which is, becaufe they fpread themfelves in a twofold manner, *viz.* upwards and downwards, as well as fidewife.

The particles of light are fubject to the laws of attraction of cohefion, like other fmall bodies; for if a ray of light be made to pafs by the edge of a knife, it will be diverted from its natural courfe, and be inflected towards the edge of the knife. The like inflection happens to a ray when it enters obliquely into a denfer or rarer fubftance than that in which it was before, in which cafe it is faid to be refracted; the laws of which refraction are the fubject of the following fection.

## Sect. II. *Of Refraction.*

123 Refraction defined.

Light, when proceeding from a luminous body, without being reflected from any opaque fubftance, or inflected by paffing very near one, is invariably found to proceed in ftraight lines, without the leaft deviation. But if it happens to pafs obliquely from one medium to another, it always leaves the direction it had before, and affumes a new one; and this change of courfe is called its *refraction*. After having taken this new direction, it then proceeds invariably in a ftraight line till it meets with a different medium, when it is again turned out of its courfe. It muft be obferved, however, that though by this means we may caufe the rays of light make any number of angles in their courfe, it is impoffible for us to make them defcribe a curve, except in one fingle cafe, namely, where they pafs through a medium, the denfity of which uniformly either increafes or decreafes. This is the cafe with the light of the celeftial bodies, which paffes downwards through our atmofphere, and likewife with that which is reflected upwards through it by terreftrial objects. In both thefe cafes, it defcribes a curve of the hyperbolic kind; but at all other times it proceeds in ftraight lines, or in what may be taken for ftraight lines without any fenfible error. 124 In what cafe the rays of light defcribe a curve.

### § 1. *The caufe of Refraction, and the law by which it is performed.*

125 Phenomena of refraction folved by an attractive power in the medium.

The phenomena of refraction are explained by an attractive power in the medium through which light paffes, in the following manner: All bodies being endowed with an attractive force, which is extended to fome diftance beyond their furfaces; when a ray of light paffes out of a rarer into a denfer medium (if this latter has a greater attractive force than the former, as is commonly the cafe), the ray, juft before its entrance, will begin to be attracted towards the denfer medium; and this attraction will continue to act upon it, till fome time after it has entered the medium; and therefore, if a ray approaches a denfer medium in a direction perpendicular to its furface, its velocity will be continually accelerated during its paffage through the fpace in which that attraction exerts itfelf; and therefore, after it has paffed that fpace, it will move on, till it arrives at the oppofite fide of the medium, with a greater degree of velocity than it had before it entered. So that in this cafe its velocity only will be altered. Whereas, if a ray enters a denfer medium obliquely, it will not only have its velocity augmented thereby, but its direction will become lefs oblique to the furface. Juft as when a ftone is thrown downwards obliquely from a precipice, it falls to the furface of the ground in a direction nearer to a perpendicular one, than that with which it was thrown from the hand. From hence we fee a ray of light, in paffing out of a rarer into a denfer medium, is refracted towards the perpendicular; that is, fuppofing a line drawn perpendicularly to the furface of the medium, through the point where the ray enters, and extended both ways, the ray in paffing through the furface is refracted or bent towards the perpendicular line; or, which is the fame thing, the line which it defcribes by its motion after it has paffed through the furface, makes a lefs angle with the perpendicular, than the line it defcribed before. All which may be illuftrated in the following manner.

Let us fuppofe firft, that the ray paffes out of a vacuum into the denfer medium ABCD (fig. 3.), and that the attractive force of each particle in the medium is extended from its refpective centre to a diftance equal to that which is between the lines AB and EF, or AB and GH; and let KL be the path defcribed by a ray of light in its progrefs towards the denfer medium. This ray, when it arrives at L, will enter the attractive forces of thofe particles which lie in AB the furface of the denfer medium, and will therefore ceafe to proceed any longer in the right line KLM, but will be diverted from its courfe by being attracted towards the Plate CCLIV.

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the line AB, and will begin to describe the curve LN passing through the surface AB in some new direction, as OQ; thereby making a less angle with a line, as PR, drawn perpendicularly through the point N, than it would have done had it proceeded in its first direction KLM.

Farther: Whereas, we have supposed the attractive force of each particle to be extended through a space equal to the distance between AB and EF, it is evident that the ray, after it has entered the surface, will still be attracted downwards, till it has arrived at the line EF; for, till that time, there will not be so many particles above it which will attract it upwards, as below, that will attract it downwards. So that after it has entered the surface at N, in the direction OQ, it will not proceed in that direction, but will continue to describe a curve, as NS; after which it will proceed straight on towards the opposite side of the medium, being attracted equally every way; and therefore will at last proceed in the direction XST, still nearer the perpendicular PR than before.

Now if we suppose ABZY not to be a vacuum, but a rarer medium than the other, the case will still be the same; but the ray will not be so much refracted from its rectilineal course, because the attraction of the particles of the upper medium being in a contrary direction to that of the attraction of those in the lower one, the attraction of the denser medium will in some measure be destroyed by that of the rarer.

On the contrary, when a ray passes out of a denser into a rarer medium, if its direction be perpendicular to the surface of the medium, it will only lose somewhat of its velocity, in passing through the spaces of attraction of that medium (that is, the space wherein it is attracted more one way than it is another). If its direction be oblique, it will continually recede from the perpendicular during its passage, and by that means have its obliquity increased, just as a stone thrown up obliquely from the surface of the earth increases its obliquity all the time it rises. Thus, supposing the ray TS passing out of the denser medium ABCD into the rarer ABZY, when it arrives at S it will begin to be attracted downwards, and so will describe the curve SNL, and then proceed in the right line LK; making a larger angle with the perpendicular PR, than the line TSX in which it proceeded during its passage through the other medium.

We may here make a general observation on the forces which produce this deviation of the rays of light from their original path. They arise from the joint action of all the particles of the body which are sufficiently near the particle of light; that is, whose distance from it is not greater than the line AE or GA; and therefore the whole force which acts on a particle in its different situations between the planes GH and EF, follows a very different law from the force exerted by one particle of the medium.

The space through which the attraction of cohesion of the particles of matter is extended is so very small, that in considering the progress of a ray of light out of one medium into another, the curvature it describes in passing through the space of attraction is generally neglected; and its path is supposed to be bent, or, in the usual terms, the ray is supposed to be refracted only in the point where it enters the denser medium.

Now the line which a ray describes before it enters a denser or a rarer medium, is called the *incident ray*: that which it describes after it has entered, is the *refracted ray*.

The angle comprehended between the incident ray and the perpendicular, is the *angle of incidence*; and that between the refracted ray and the perpendicular, is the *angle of refraction*.

There is a certain and immutable law or rule, by which refraction is always performed; and that is this: Whatever inclination a ray of light has to the surface of any medium before it enters it, the degree of refraction will always be such, that the proportion between the sine of the angle of its incidence, and that of the angle of its refraction, will always be the same in that medium.

Plate CCCLIV.

To illustrate this: Let us suppose ABCD (fig. 4.) to represent a rarer, and ABEF a denser medium: let GH be a ray of light passing through the first and entering the second at H, and let HI be the refracted ray: then supposing the perpendicular PR drawn through the point H, on the centre H, and with any radius, describe the circle APBR; and from G and I, where the incident and refracted rays cut the circle, let fall the lines GK and IL, perpendicularly upon the line PR; the former of these will be the sine of the angle of incidence, the latter of refraction. Now if in this case the ray GH is so refracted at H, that GK is double or triple, &c. of IL, then, whatever other inclination the ray GH might have had, the sine of its angle of incidence would have been double or triple, &c. to that of its angle of refraction. For instance, had the ray passed in the line MH before refraction, it would have passed in some line as HN afterwards, so situated that MO should have been double or triple, &c. of NQ.

When a ray passes out of a vacuum into air, the sine of the angle of incidence is found to be to that of refraction as 100036 to 100000.

When it passes out of air into water, as about 4 to 3.

When out of air into glass, as about 17 to 11.

When out of air into a diamond, as about 5 to 2.

This relation of the sine of the angle of incidence to that of refraction, which is a proposition of the most extensive use in explaining the optical phenomena on physical or mechanical principles, may be demonstrated in the following easy and familiar manner.

*Lemma* I. The augmentations or diminutions of the squares of the velocities produced by the uniform action of accelerating or retarding forces, are proportional to the forces, and to the spaces along which they act, jointly, or are proportional to the products of the forces multiplied by the spaces.

Let two bodies be uniformly accelerated from a state of rest in the points A *a*, along the spaces AB, *a b*, fig. 5. by the accelerated forces F *f*, and let AC, *a c*, be spaces described in equal times; it is evident, from what has been said under the articles Gravity and Acceleration, that because these spaces are described with motions uniformly accelerated, AC and *ac* are respectively the halves of the spaces which would be uniformly described during the same time with the velocities acquired at C and *c*, and are therefore

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therefore measures of these velocities. And as these velocities are uniformly acquired in equal times, they are measures of the accelerating forces. Therefore $AC : ac = F : f$. Also, from the nature of uniformly accelerated motion, the spaces are proportional to the squares of the acquired velocities. Therefore, (using the symbols $\surd^2 C$, $\surd^2 c$, &c. to express the squares of the velocities at C $c$, &c.) we have

$$\surd^2 B : \surd^2 C = AB : AC$$
$$\surd^2 C : \surd^2 c = AC^2 : ac^2$$
$$\surd^2 c : \surd^2 b = ac : ab$$

Therefore, by equality of compound ratios

$$\surd^2 B : \surd^2 b = AB \times AC : ab \times ac, = AB \times F : ab \times f.$$

And, in like manner $\surd^2 D : \surd^2 d = AD \times F : ad \times f$; and $\surd^2 B - \surd^2 D : \surd^2 b - \surd^2 d = BD \times F : bd \times f$. Q. E. D.

*Corol.* If the forces are as the spaces inversely, the augmentations or diminutions of the squares of the velocities are equal.

*Remark.* If DB, $db$, be taken extremely small, the products $BD \times F$ and $bd \times f$ may be called the momentary actions of the forces, or the momentary increments of the squares of the velocities. It is usually expressed, by the writers on the higher mechanics, by the symbol $f\dot{s}$, or $fds$, where $f$ means the accelerating force, and $\dot{s}$ or $ds$ means the indefinitely small space along which it is uniformly exerted. And the proposition is expressed by the fluxionary equation $f\dot{s} = v\dot{v}$, because $v\dot{v}$ is half the increment of $v^2$, as is well known.

Plate CCCLIV. fig. 6.

*Lemma* 2. (being the 39th proposition of the first book of Newton's Principia.) If a particle of matter, moving with any velocity along the line AC, be impelled by an accelerating or retarding force, acting in the same or in the opposite direction, and if the intensity of the force in the different points B, F, H, C, &c. be as the ordinates BD, FG, &c. to the line DGE, the areas BFGD, BHKD, &c. will be as the changes made on the square of the velocity at B, when the particle arrives at the points F, H, &c.

For let BC be divided into innumerable small portions, of which let FH be one, and let the force be supposed to act uniformly, or to be of invariable intensity during the motion along FH; draw GI perpendicular to HK: It is evident that the rectangle FHIG will be as the product of the accelerating force by the space along which it acts, and will therefore express the momentary increment of the square of the velocity. (Lemma 1.) The same may be said of every such rectangle. And if the number of the portions, such as FH, be increased, and their magnitude diminished without end, the rectangles will ultimately occupy the whole curvilineal area, and the force will be continually varying in its intensity. The curvilineal areas will therefore be as the finite changes made on the square of the velocity, and the proposition is demonstrated.

*Corol.* The whole change made on the square of the velocity, is equal to the square of that velocity which the accelerating force would communicate to the particle by impelling it along BC from a state of rest in B. For the area BCED will still express the square of this velocity, and it equally expresses the change made on the square of *any* velocity wherewith the particle may pass through the point B, and is independent on the magnitude of that velocity.

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*Remark.* The figure is adapted to the case where the forces all conspire with the initial motion of the particle, or all oppose it, and the area expresses an augmentation or a diminution of the square of the initial velocity. But the reasoning would have been the same, although, in some parts of the line BC, the forces had conspired with the initial motion, and in other parts had opposed it. In such a case, the ordinates which express the intensity of the forces must lie on different sides of the abscissa BC, and that part of the area which lies on one side must be considered as negative with respect to the other, and be subtracted from it. Thus, if the forces are represented by the ordinates of the dotted curve line DH$e$, which crosses the abscissa in H, the figure will correspond to the motion of a particle, which, after moving uniformly along AB, is subjected to the action of a variable accelerating force during its motion along BH, and the square of its initial velocity is increased by the quantity BHD; after which it is retarded during its motion along HC, and the square of its velocity in H is diminished by a quantity HC$e$. Therefore the square of the initial velocity is changed by a quantity BHD—HC$e$, or HC$e$—BHD.

This proposition is perhaps the most important in the whole science of mechanics, being the foundation of every application of mechanical theory to the explanation of natural phenomena. No traces of it are to be found in the writings of philosophers before the publication of Newton's Principia, although it is assumed by John Bernoulli and other detractors from Newton's greatness as an elementary truth, without any acknowledgment of their obligations to its author. It is usually expressed by the equation $f\dot{s} = v\dot{v}$ and $\int f\dot{s} = v^2$, *i. e.* the sum of the momentary actions is equal to the whole or finite increment of the square of the velocity.

## PROPOSITION.

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The ratio of the sine of incidence to the sine of refraction.

When light passes obliquely into or out of a transparent substance, it is refracted so that the sine of the angle of incidence is to the sine of the angle of refraction in the constant ratio of the velocity of the refracted light to that of the incident light.

Let ST, KR (fig. 7.), represent two planes (parallel to, and equidistant from, the refracting surface XY) which bound the space in which the light, during its passage, is acted on by the refracting forces, as explained in N° 125. The intensity of the refracting forces being supposed equal at equal distances from the bounding planes, though anyhow different at different distances from them, may be represented by the ordinates T $a$, $n q$, $p r$, $c$ R, &c. of the curve $a\,b\,n\,p\,c$, of which the form must be determined from observation, and may remain for ever unknown. The phenomena of inflected light show us that it is attracted by the refracting substance at some distances, and repelled at others.

Let the light, moving uniformly in the direction AB, enter the refracting stratum at B. It will not proceed in that direction, but its path will be incurvated upwards, while acted on by a repulsive force,

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and downwards, while impelled by an attractive force. It will deſcribe ſome curvilineal path B*do* CDE, which AB touches in B, and will finally emerge from the refracting ſtratum at E, and move uniformly in a ſtraight line EF, which touches the curve in E. If, through *b*, the interſection of the curve of forces with its abſciſſa, we draw *b o*, cutting the path of the light in *o*, it is evident that this path will be concave upwards between B and *o*, and concave downwards between *o* and E. Alſo, if the initial velocity of the light has been ſufficiently ſmall, its path may be ſo much bent upwards, that in ſome point *d* its direction may be parallel to the bounding planes. In this caſe it is evident, that being under the influence of a repulſive force, it will be more bent upwards, and it will deſcribe *d f*, equal and ſimilar to *d* B, and emerge in an angle *g f s*, equal to ABG. In this caſe it is reflected, making the angle of reflection equal to that of incidence. By which it appears how reflection, refraction, and inflection, are produced by the ſame forces and performed by the ſame laws.

But let the velocity be ſuppoſed ſufficiently great to enable the light to penetrate through the refracting ſtratum, and emerge from it in the direction EF; let AB and EF be ſuppoſed to be deſcribed in equal times: They will be proportional to the initial and final velocities of the light. Now, becauſe the refracting forces *muſt* act in a direction perpendicular to the refracting ſurface (ſince they ariſe from the joint action of all the particles of a homogeneous ſubſtance which are within the ſphere of mutual action), they cannot affect the motion of the light eſtimated in the direction of the refracting ſurface. If, therefore, AG be drawn perpendicular to ST, and FK to KR, the lines GB, EK, muſt be equal, becauſe they are the motions AB, EF, eſtimated in the direction of the planes. Draw now EL parallel to AB. It is alſo equal to it. Therefore EL, EF, are as the initial and final velocities of the light. But EF is to EL as the ſine of the angle ELK to the ſine of the angle EFK; that is, as the ſine of the angle ABH to the ſine of the angle FEI; that is, as the ſine of the angle of incidence to the ſine of the angle of refraction.

By the ſame reaſoning it will appear that light, moving in the direction and with the velocity FE, will deſcribe the path EDB, and will emerge in the direction and with the velocity BA.

Let another ray enter the refracting ſtratum perpendicularly at B, and emerge at Q. Take two points N, P, in the line BQ, extremely near to each other, ſo that the refracting forces may be ſuppoſed to act uniformly along the ſpace NP: draw NC, PD, parallel to ST, CM perpendicular to DP, and MO perpendicular to CD, which may be taken for a ſtraight line. Then, becauſe the forces at C and N are equal, by ſuppoſition they may be repreſented by the equal lines CM and NP. The force NP is wholly employed in accelerating the light along NP; but the force CM being tranſverſe to the motion BD, is but partly ſo employed, and may be conceived as ariſing from the joint action of the forces CO, OM, of which CO only is employed in accelerating the motion of the light, while OM is employed in incurvating its path. Now it is evident, from the ſimilarity of the triangles DCM, MCO, that DC : CM=CM : CO, and that DC×CO=CM×CM=NP×NP. But DC×CO and NP×NP are as the products of the ſpaces by the accelerating forces, and expreſs the momentary increments of the ſquares of the velocities at C and N. (Lemma 1.) Theſe increments, therefore, are equal. And as this muſt be ſaid of every portion of the paths BCE and BNQ, it follows that the whole increment of the ſquare of the initial velocity produced in the motion along BCE, is equal to the increment produced in the motion along BNQ. And, becauſe the initial velocities were equal in both paths, their ſquares were equal. Therefore the ſquares of the final velocities are alſo equal in both paths, and the final velocities themſelves are equal. The initial and final velocities are therefore in a conſtant ratio, whatever are the directions; and the ratio of the ſines of the angles of incidence and refraction being the ratio of the velocities of the refracted and incident light, by the former caſe of Prop. 1. is alſo conſtant.

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*Remark*. The augmentation of the ſquare of the initial velocity is equal to the ſquare of the velocity which a particle of light would have acquired, if impelled from a ſtate of reſt at B along the line BQ (Corol. of the Lemma 2.), and is therefore independent on the initial velocity. As this augmentation is expreſſed by the curvilineal area *a* T *b n p c* R, it depends both on the intenſity of the refracting forces, expreſſed by the ordinates, and on the ſpace through which they act, viz. TR. Theſe circumſtances ariſe from the nature of the tranſparent ſubſtance, and are characteriſtic of that ſubſtance. Therefore, to abbreviate language, we ſhall call this the *ſpecific velocity*.

This ſpecific velocity is eaſily determined for any ſubſtance in which the refraction is obſerved, by drawing L *i* perpendicular to EL, meeting in *i* the circle deſcribed with the radius EF. For E *i* being equal to EF, will repreſent the velocity of the refracted light, and EL repreſent the velocity of the incident light, and $Ei^2=EL^2+Li^2$, and therefore $Li^2$ is the augmentation of the ſquare of the initial velocity, and L *i* is the ſpecific velocity.

It will now be proper to deduce ſome corollaries from theſe propoſitions, tending to explain the chief phenomena of refraction.

127 The motion of light accelerated or retarded by refraction.

1. When light is refracted towards the perpendicular to the refracting ſurface, it is accelerated; and it is retarded when it is refracted from the perpendicular. In the firſt caſe, therefore, it muſt be conſidered as having been acted on by forces conſpiring (in part at leaſt) with its motion, and *vice verſa*. Therefore, becauſe we ſee that it is always refracted towards the perpendicular, when paſſing from a void into any tranſparent ſubſtance, we muſt conclude that it is, on the whole, attracted by that ſubſtance. We muſt draw the ſame concluſion from obſerving, that it is refracted from the perpendicular in its paſſage out of any tranſparent ſubſtance whatever into a void. It has been attracted backwards by that ſubſtance.

This acceleration of light in refraction is contrary to the opinion of thoſe philoſophers who maintain, that illumination is produced by the undulation of an elaſtic medium. Euler attempts to prove, by mechanical laws, that the velocities of the incident and refracted light are proportional to the ſines of incidence and refraction, while our principles make them in this ratio

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ratio inversely. Boscovich proposed a fine experiment for deciding this question. The aberration of the fixed stars arises from the combination of the motion of light with the motion of the telescope by which it is observed. Therefore this aberration should be greater or less when observed by means of a telescope filled with water, according as light moves slower or swifter through water than through air. He was mistaken in the manner in which the conclusion should be drawn from the observation made in the form prescribed by him: and the experiment has not yet been made in a convincing manner; because no fluid has been found of sufficient transparency to admit of the necessary magnifying power. It is an experiment of the greatest importance to optical science.

2. If the light be moving within the transparent substance, and if its velocity (estimated in a direction perpendicular to the surface) do not exceed the specific velocity of that substance, it will not emerge from it, but will be reflected backwards in an angle equal to that of its incidence. For it must be observed, that in the figure of last proposition, the excess of the square of EF above the square of EL, is the same with the excess of the square of KF above the square of KL. Therefore the square of the specific velocity is equal to the augmentation or diminution of the square of the perpendicular velocity. If therefore the initial perpendicular velocity FK (fig. 8.) be precisely equal to the specific velocity, the light will just reach the farther side of the attracting stratum, as at B, where its perpendicular velocity will be completely extinguished, and its motion will be in the direction BT. But it is here under the influence of forces tending towards the plane KR, and its motion will therefore be still incurvated towards it; and it will describe a curve BD equal and similar to EB, and finally emerge back from the refracting stratum into the transparent substance in an angle RDA equal to KEF.

Plate CCLIV.

If the direction of the light be still more oblique, so that its perpendicular velocity is less than the specific velocity, it will not reach the plane ST, but be reflected as soon as it has penetrated so far that the specific velocity of the part penetrated (estimated by the compounding part of the area of forces) is equal to its perpendicular velocity. Thus the ray $fE$ will describe the path E$d$D$a$ penetrating to $bd$, so that the corresponding area of forces $abce$ is equal to the square of $fk$, its perpendicular volocity.

The extreme brilliancy of dew drops and of jewels had often excited the attention of philosophers, and it always appeared a difficulty how light was reflected at all from the posterior surface of transparent bodies. It afforded Sir Isaac Newton his strongest argument against the usual theory of reflection, viz. that it was produced by impact on solid elastic matter. He was the first who took notice of the total reflection in great obliquities; and very properly asked how it can be said that there is any impact in this case, or that the reflecting impact should cease at a particular obliquity?

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Rays at a certain obliquity are wholly reflected by transparent substances.

It must be acknowledged that it is a very curious circumstance, that a body which is perfectly transparent should cease to be so at a certain obliquity; that a great obliquity should not hinder light from passing from a void into a piece of glass; but that the same obliquity should prevent it from passing from the glass into a void. The finest experiment for illustrating the fact is, to take two pieces of mirror-glass, not silvered, and put them together with a piece of paper between them, forming a narrow margin all round to keep them apart. Plunge this apparatus into water. When it is held nearly parallel to the surface of the water, every thing at the bottom of the vessel will be seen clearly through the glasses; but when they are turned so as to be inclined about 50 degrees, they will intercept the light as much as if they were plates of iron. It will be proper to soak the paper in varnish, to prevent water from getting between the glasses.

129
The brilliant cut in diamonds produces total reflection.

What is called the brilliant cut in diamonds, is such a disposition of the posterior facets of the diamond, that the light is made to fall upon them so obliquely that none of it can go through, but all is reflected. To produce this effect in the greatest possible degree is a matter of calculation, and merits the attention of the lapidary. When diamonds are too thin to admit of this form, they are cut in what is called the rose fashion. This has a plain back, and the facets are all on the front, and so disposed as to refract the rays into sufficient obliquities, to be strongly reflected from the posterior plane. Doublets are made by cutting one thin diamond rose fashion, and another similar one is put behind it, with their plane surfaces joined. Or, more frequently, the outside diamond has the anterior facets of the brilliant, and the inner has the form of the inner part of a brilliant. If they be joined with very pure and strongly refracting varnish, little light is reflected from the separating plane, and their brilliancy is very considerable, though still inferior to a true and deep brilliant. If no varnish be used, much of the light is reflected from the flat side, and the effect of the posterior facets is much diminished. But doublets might be constructed, by making the touching surfaces of a spherical form (of which the curvature should have a due proportion to the size of the stone), that would produce an effect nearly equal to that of the most perfect brilliant.

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Refraction diminishes as the incident velocity increases.

3. Since the change made on the square of the velocity of the incident light is a constant quantity, it follows, that the refraction will diminish as the velocity of the incident light increases. For if L $i$ in fig. 7. be a constant quantity, and EL be increased, it is evident that the ratio of E$i$, or its equal EF, to EL will be diminished, and the angle LEF, which constitutes the refraction, will be diminished. The physical cause of this is easily seen: When the velocity of the incident light is increased, it employs less time in passing through the refracting stratum or space between the planes ST and KR, and is therefore less influenced by the refracting forces. A similar effect would follow if the transparent body were moving with great velocity towards the luminous body.

Some naturalists have accounted for the different refrangibility of the differently coloured rays, by supposing that the red rays move with the greatest rapidity, and they have determined the difference of original velocity which would produce the observed difference of refraction. But this difference would be observed in the eclipses of Jupiter's satellites. They should be ruddy at their emersions, and be some seconds before they attain their pure whiteness; and

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they should become bluish immediately before they vanish in immersions. This is not observed. Besides, the difference in refrangibility is much greater in flint glass than in crown glass, and this would require a proportionally greater difference in the original velocities. The explanation therefore must be given up.

131 The refraction of a star greater in the evening than in the morning.

It should follow, that the refraction of a star which is in our meridian at six o'clock in the evening should be greater than that of a star which comes on the meridian at six in the morning; because we are moving away from the first, and approaching to the last. But the difference is but $\frac{1}{1000}$ of the whole, and cannot be observed with sufficient accuracy in any way yet practised. A form of observation has been proposed by Dr Blair professor of practical astronomy in the university of Edinburgh, which promises a very sensible difference of refraction. It is also to be expected, that a difference will be observed in the refraction of the light from the east and western ends of Saturn's ring. Its diameter is about 26 times that of the earth, and it revolves in 10h. 32′; so that the velocity of its edge is about $\frac{1}{10000}$ of the velocity of the sun's light. If therefore the light be reflected from it according to the laws of perfect elasticity, or in the manner here explained, that which comes to us from the western extremity will move more slowly than that which comes from the eastern extremity in the proportion of 2500 to 2501. And if Saturn can be seen distinctly after a refraction of 30° through a prism, the diameter of the ring will be increased one half in one position of the telescope, and will be as much diminished by turning the telescope half round its axis; and an intermediate position will exhibit the ring of a distorted shape. This experiment is one of the most interesting to optical science, as its result will be a severe touchstone of the theories which have been attempted for explaining the phenomena on mechanical principles.

If the tail of a comet be impelled by the rays of the sun, as is with great probability supposed by Euler and others, the light by which its extreme parts are seen by us must have its velocity greatly diminished, being reflected by particles which are moving away from the sun with immense rapidity. This may perhaps be discovered by its greater aberration and refrangibility.

132 All light subject to the same

As common day light is nothing but the sun's light reflected from terrestrial bodies, it is reasonable to expect that it will suffer the same refraction. But nothing but observation could assure us that this would be the case with the light of the stars; and it is rather surprising that the velocity of their light is the same with that of the sun's light. It is a circumstance of connexion between the solar system and the rest of the universe. It was as little to be looked for on the light of terrestrial luminaries. If light be conceived as small particles of matter emitted from bodies by the action of accelerating forces of any kind, the vast diversity which we observe in the constitution of sublunary bodies should make us expect differences in this particular. Yet it is found, that the light of a candle, of a glow-worm, &c. suffers the same refraction, and consists of the same colours. This circumstance is adduced as an argument against the theory of emission. It is thought more probable that this sameness of velocity is owing to the nature of the medium, which determines the frequency of its undulations and the velocity of their propagation.

Law of refraction when light passes out of one transparent body into another contiguous to it.

4. When two transparent bodies are contiguous, the light in its passage out of the one into the other will be refracted towards or from the perpendicular, according as the refracting forces of the second are greater or less than those of the first, or rather according as the area expressing the square of the specific velocity is greater or less. And as the difference of these areas is a determined quantity, the difference between the velocity in the medium of incidence and the velocity in the medium of refraction, will also be a determined quantity. Therefore the sine of the angle of incidence will be in a constant ratio to the sine of the angle of refraction; and this ratio will be compounded of the ratio of the sine of incidence in the first medium to the sine of refraction in a void; and the ratio of the sine of incidence in a void to the sine of refraction in the second medium. If therefore a ray of light, moving through a void in any direction, shall pass through any number of media bounded by parallel planes, its direction in the last medium will be the same as if it had come into it from a void.

5. It also follows from these propositions, that if the obliquity of incidence on the posterior surface of a transparent body be such, that the light should be reflected back again, the placing a mass of the same or of another medium in contact with this surface, will cause it to be transmitted, and this the more completely, as the added medium is more dense or more refractive; and the reflection from the separating surface will be the more vivid in proportion as the posterior substanee is less dense or of a smaller refractive power. It is not even necessary that the other body be in contact; it is enough if it be so near that those parts of the refracting strata which are beyond the bodies interfere with or coincide with each other.

All these consequences are agreeable to experience. The brilliant reflection from a dew drop ceases when it touches the leaf on which it rests: The brilliancy of a diamond is greatly damaged by moisture getting behind it: The opacity of the combined mirror plates, mentioned in the second corollary, is removed by letting water get between them: A piece of glass is distinctly or clearly seen in air, more faintly when immersed in water, still more faintly amidst oil of olives, and it is hardly perceived in spirits of turpentine. These phenomena are incompatible with the notion that reflection is occasioned by impact on solid matter, whether of the transparent body, or of any ether or other fancied fluid behind it; and their perfect coincidence with the legitimate consequences of the assumed principles, is a strong argument in favour of the truth of those principles.

134 An objection to the Newtonian theory of refraction.

It is worth while to mention here a fact taken notice of by Mr Beguelin, and proposed as a great difficulty in the Newtonian theory of refraction. In order to get the greatest possible refraction, and the simplest measure of the refracting power at the anterior surface of any transparent substance, Sir Isaac Newton enjoins us to employ a ray of light falling on the surface *quam obliquissime*. But Mr Beguelin found, that when the obliquity of incidence in glass was about

89°

Cause of Refraction.

89° 50′, no light was refracted, but that it was wholly reflected. He also observed, that when he gradually increased the obliquity of incidence on the posterior surface of the glass, the light which emerged last of all did not skim along the surface, making an angle of 90° with the perpendicular, as it should do by the Newtonian theory, but made an angle of more than ten minutes with the posterior surface. Also, when he began with very great obliquities, so that all the light was reflected back into the glass, and gradually diminished the obliquity of incidence, the first ray of light which emerged did not skim along the surface, but was raised about 10 or 15 minutes.

135 Shown to be the necessary consequence of that theory, and of course a confirmation of it.

But all these phenomena are necessary consequences of our principles, combined with what observation teaches us concerning the forces which bodies exert on the rays of light. It is evident, from the experiments of Grimaldi and Newton, that light is both attracted and repelled by solid bodies. Newton's sagacious analysis of these experiments discovered several alternations of actual inflection and deflection; and he gives us the precise distance from the body when some of these attractions end and repulsion commences; and the most remote action to be observed in his experiments is repulsion. Let us suppose this to be the case, although it be not absolutely necessary. Let us suppose that the forces are represented by the ordinates of a curve *a b n p c* (fig. 7.) which crosses the abscissa in *b*. Draw *b o* parallel to the refracting surface. When the obliquity of incidence of the ray A B has become so great, that its path in the glass, or in the refracting stratum, does not cut, but only touches the line *o b*, it can penetrate no further, but is totally reflected; and this must happen in all greater obliquities. On the other hand, when the ray LE, moving within the glass, has but a very small perpendicular velocity, it will penetrate the refracting stratum no further than till this perpendicular velocity is extinguished, and its path becomes parallel to the surface, and it will be reflected back. As the perpendicular velocity increases by diminishing the obliquity of incidence, it will penetrate farther; and the last reflection will happen when it penetrates so far that its path touches the line *o b*. Now diminish the obliquity by a single second; the light will get over the line *o b*, will describe an arch *o d* B concave upwards, and will emerge in a direction BA, which does not skim the surface, but is sensibly raised above it. And thus the facts observed by M. Beguelin, instead of being an objection against this theory, afford an argument in its favour.

Plate CCCLIV.

136 Euler's theory of undulation contrary to fact;

7. Those philosophers who maintain the theory of undulation, are under the necessity of connecting the dispersive powers of bodies with their mean refractive powers. M. Euler has attempted to deduce a necessary difference in the velocity of the rays of different colours from the different frequency of the undulations, which he assigns as the cause of their different colorific powers. His reasoning on this subject is of the most delicate nature, and unintelligible to such as are not completely master of the infinitesimal calculus of partial differences, and is unsatisfactory to such as are able to go through its intricacies. It is contradicted by fact. He says, and indeed to be consistent he must say it, that musical sounds which differ greatly in acuteness are propagated through the air with different velocities: but one of the smallest bells in the chimes of St Giles's church in Edinburgh was struck against the rim of the very deep-toned bell on which the hours are struck. When the sound was listened to by a nice observer at the distance of more than two miles, no interval whatever could be observed. A similar experiment was exhibited to M. Euler himself, by means of a curious musical instrument (if it can be so called) used at St Petersburgh, and which may be heard at three or four miles distance. But the experiment with the bells is unexceptionable, as the two sounds were produced in the very same instant. This connexion between the refrangibility in general and the velocity must be admitted, in its full extent, in every attempt to explain refraction by undulation; and Euler was forced by it to adopt a certain consequence which made a necessary connection between the mean refraction and the dispersion of heterogeneous rays. Confident of his analysis, he gave a deaf ear to all that was told him of Mr Dollond's improvements on telescopes, and asserted, that they could not be such as were related; for an increase of mean refraction must always be accompanied with a *determined* increase of dispersion. Newton had said the same thing, being misled by a limited view of his own principles; but the dispersion assigned by him was different from that assigned by Euler. The dispute between Euler and Dollond was confined to the decision of this question only; and when some glasses made by a German chemist at St Petersburgh convinced Euler that his determination was erroneous, he had not the candour to give up the principle which had forced him to this determination of the dispersion, but immediately introduced a new theory of the achromatic telescopes of Dollond; a theory which took the artists out of the track marked out by mathematicians, and in which they had made considerable advances, and led them into another path, proposing *maxims* of construction hitherto untried, and inconsistent with real improvements which they had already made. The leading principle in this theory is to arrange the different ultimate images of a point which arise either from the errors of a spherical figure or different refrangibility, in a straight line passing through the centre of the eye. The theory itself is specious; and it requires great mathematical skill to accomplish this point, and hardly less to decide on the propriety of the construction which it recommends. It is therefore but little known. But that it is a false theory, is evident from one simple consideration. In the most indistinct vision arising from the worst construction, this rectilineal arrangement of the images obtains completely in that pencil which is situated in the axis, and yet the vision is indistinct. But, what is to our present purpose, this new theory is purely mathematical, suiting any observed dispersive power, and has no connexion with the physical theory of undulations, or indeed with any mechanical principles whatever. But, by admitting any dispersive power, whatever may be the mean refraction, all the physical doctrines in his *Nova Theoria Lucis et Colorum* are overlooked, and therefore never once mentioned, although the effects of Mr Zeiher's glass are taken notice of as inconsistent with that mechanical proposition.

137 and misleads artists.

proposition of Newton's which occasioned the whole dispute between Euler and Dollond.

They are indeed inconsistent with the universality of that proposition. Newton advances it in his Optics merely as a mathematical proposition highly probable, but says that it will be corrected if *he shall find it* false. The ground on which he *seems* (for he does not expressly say so) to rest its probability is a limited view of his own principle, the action of bodies on light. He (not knowing any cause to the contrary) supposed that the action of all bodies was similar on the different kinds of light, that is, that the specific velocities of the differently coloured rays had a determined proportion to each other. This was gratuitous; and it might have been doubted by him who had observed the analogy between the chemical actions of bodies by elective attractions and repulsions, and the similar actions on light. Not only have different menstrua unequal actions on their solids, but the order of their affinities is also different. In like manner, we might expect not only that some bodies would attract light in general more than others, but also might differ in the proportion of their actions on the different kinds of light, and this so much, that some might even attract the red more than the violet. The late discoveries in chemistry show us some very distinct proofs, that light is not exempted from the laws of chemical action, and that it is susceptible of chemical combination. The changes produced by the sun's light on vegetable colours, shows the necessity of illumination to produce the green fecula; and the aromatic oils of plants, the irritability of their leaves by the action of light, the curious effects of it on the mineral acids, on manganese, and the calces of bismuth and lead, and the imbibition and subsequent emission of it by phosphorescent bodies, are strong proofs of its chemical affinities, and are quite inexplicable on the theory of undulations.

All these considerations taken together, had they been known to Sir Isaac Newton, would have made him expect differences quite anomalous in the dispersive powers of different transparent bodies; at the same time that they would have afforded to his sagacious mind the strongest arguments for the actual emission of light from the luminous body.

HAVING in this manner established the observed law of refraction on mechanical principles, showing it to be a necessary consequence of the known action of bodies on light, we proceed to trace its mathematical consequences through the various cases in which it may be exhibited to our observation. These constitute that part of the mathematical branch of optical science which is called *dioptrics*.

138 The variation of the intensity of attractions and repulsions unknown.

We are quite unacquainted with the law of action of bodies on light, that is, with the variation of the intensity of the attractions and repulsions exerted at different distances. All that we can say is, that from the experiments and observations of Grimaldi, Newton, and others, light is deflected towards a body or is attracted by it, at some distances, and repelled at others, and this with a variable intensity. The action may be extremely different, both in extent and force, in different bodies, and change by a very different law with the same change of distance. But, amidst all this variety, there is a certain similarity arising from the joint action of many particles, which should be noticed, because it tends both to explain the similarity observed in the refractions of light, and also its connexion with the phenomena of reflection.

The law of variation in the action of many particles different from that of one; but may be known if it be known. Plate CCCLIV.

The law of variation in the joint action of many particles adjoining to the surface of a refracting medium, is extremely different from that of a single particle; but when this last is known, the other may be found out. We shall illustrate this matter by a very simple case. Let DE (fig. 9.) be the surface of a medium, and let us suppose that the action of a particle of the medium on a particle of light extends to the distance EA, and that it is proportional to the ordinates ED, F*f*, G*g*, H*h*, &c. of the line A*b*C*gf*D; that is, that the action of the particle E of the medium on a particle of light in F, is to its action on a particle in H as F*f* to H*h*, and that it is attracted at F but repelled at H, as expressed by the situation of the ordinates with respect to the abscissa. In the line AE produced to B, make EB, E$\chi$, E$\kappa$, E$\gamma$, E$\varphi$, &c. respectively equal to EA, EH, EC, EG, EF, &c.

It is evident that a particle of the medium at B will exert no action on the particle of light in E, and that the particles of the medium in $\kappa\ \gamma\ \varphi$ E, will exert on it actions proportional to H*h*, G*g*, F*f*, ED. Therefore, supposing the matter of the medium continuous, the whole action exerted by the row of particles EB will be represented by the area A*b*CDE; and the action of the particles between B and $\varphi$ will be represented by the area A*b*C*f*F, and that of the particles between E and $\varphi$ by the area F*f*DE.

Now let the particle of light be in F, and take F*o*=AE. It is no less evident that the particle of light in F will be acted on by the particles in E*o* alone, and that it will be acted on in the same manner as a particle in E is acted on by the particles in $\varphi$B. Therefore the action of the whole row of particles EB on a particle in F will be represented by the area A*b*C*f*F. And thus the action on a particle of light in any point of AE will be represented by the area which lies beyond it.

But let us suppose the particles of light to be within the medium, as at $\varphi$, and make $\varphi d$=AE. It is again evident that it is acted on by the particles of the medium between $\varphi$ and *d* with a force represented by the area A*b*CDE, and in the opposite direction by the particles in E$\varphi$ with a force represented by the area F*f* DE. This balances an equal quantity of action, and there remains an action expressed by the area A*b*C*f*F. Therefore, if an equal and similar line to A*b*CDE be described on the abscissa EB, the action of the medium on a particle of light in $\varphi$ will be represented by the area $\varphi f \kappa h$B, lying beyond it.

If we now draw a line AKLMRNPB, whose ordinates CK, FQ, $\varphi$R, &c. are as the areas of the other curve, estimated from A and B; these ordinates will represent the whole forces which are exerted by the particles in EB, on a particle of light moving from A to B. This curve will cut the axis in points L, N such, that the ordinates drawn through them intercept areas of the first curve, which are equal on each side of the axis; and in these points the particle of light sustains no action from the medium. These points are

very

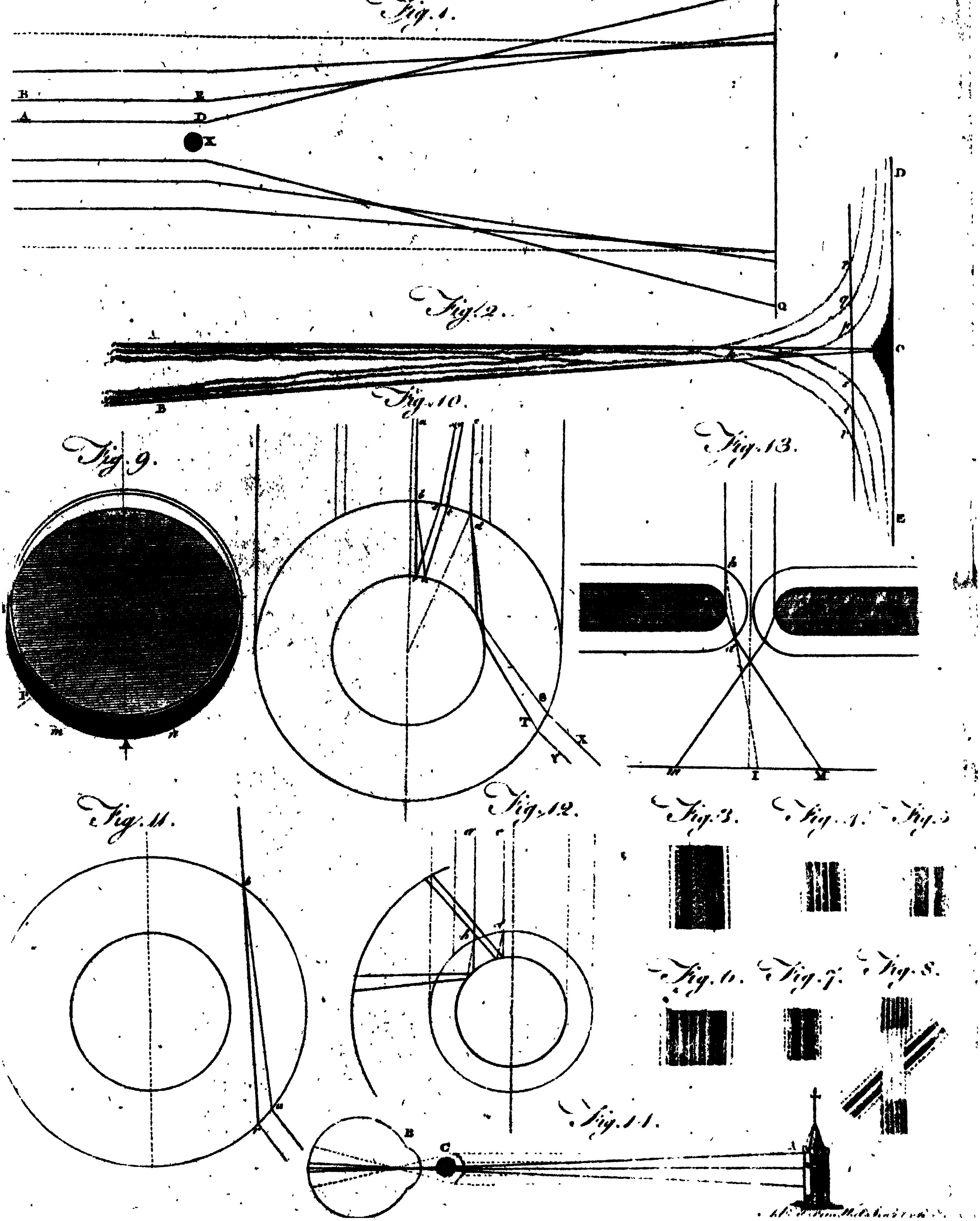
Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 6.
Fig. 7.
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Fig. 10.
Fig. 11.
Fig. 12.
Fig. 13.
Fig. 14.

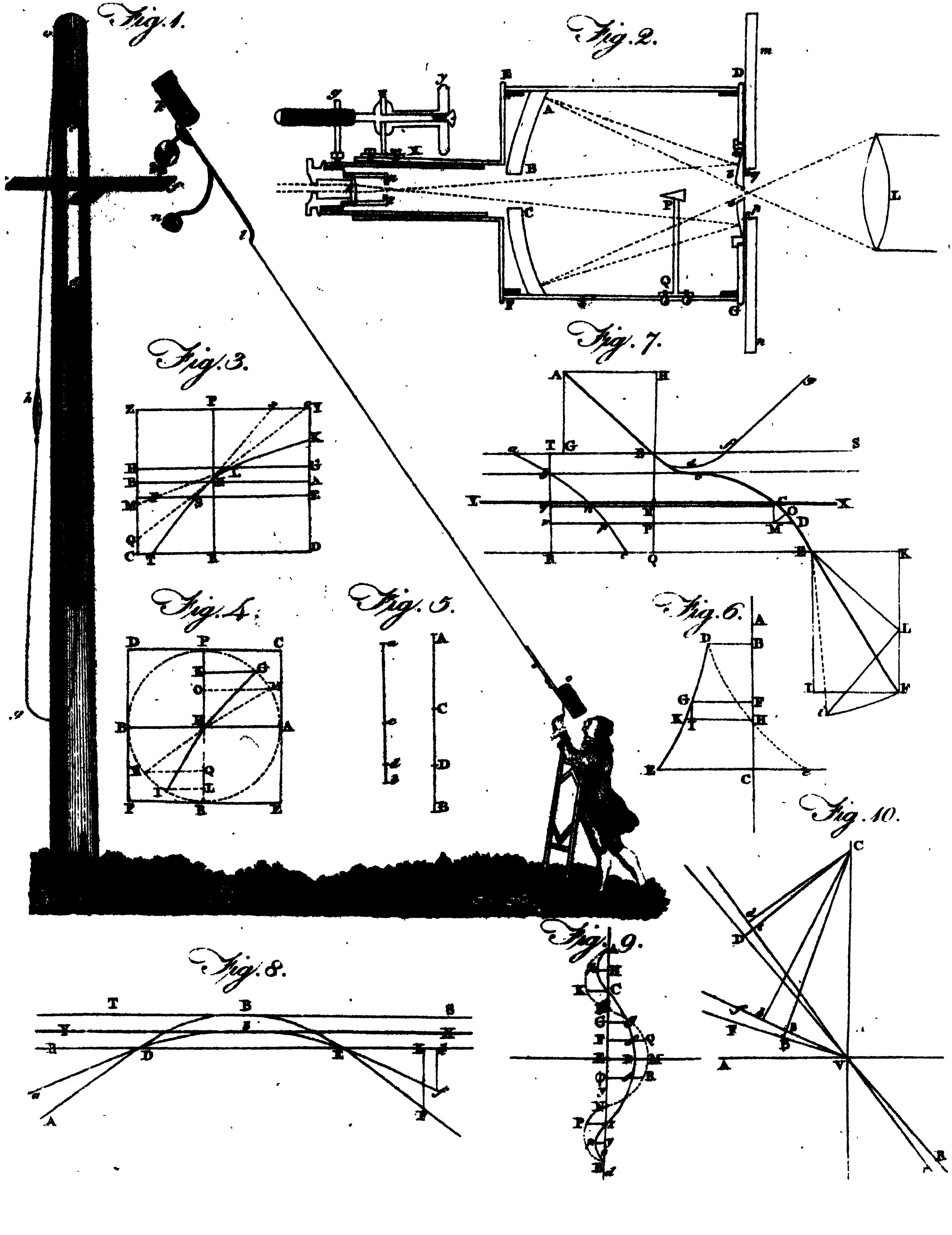

Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.

Cause of Refraction.

very different from the similar points of the curve expressing the action of a single particle. These last are in the very places where the light sustains the greatest repulsive action of the whole row of particles. In the same manner may a curve be constructed, whose ordinates express the united action of the whole medium.

From these observations we learn in general, that a particle of light within the space of action is acted on with equal forces, and in the same direction, when at equal distances on each side of the surface of the medium.

*Of the focal distance of rays refracted by passing out of one medium into another of different density and through a plane surface.*

*Lemma.* The indefinitely small variation of the angle of incidence is to the simultaneous variation of the angle of refraction as the tangent of incidence is to the tangent of refraction; or, the cotemporaneous variations of the angles of incidence and refraction are proportional to the tangents of these angles.

Plate CCLIV.

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Laws of refraction in plane surfaces.

Let RVF, $rVf$ (fig. 10.) be the progress of the rays refracted at V (the angle $rVR$ being considered in its nascent or evanescent state), and VC perpendicular to the refracting surface VA. From C draw CD, CB, perpendicular to the incident and refracted rays RV, VF, cutting $rV$, $Vf$ in $\delta$ and $\beta$, and let C$d$, C$b$ be perpendicular to $rV$, $Vf$.

Because the sines of incidence and refraction are in a constant ratio, their simultaneous variations are in the same constant ratio. Now the angle $RVr$ is to the angle $FVf$ in the ratio of $\frac{B\beta}{BV}$ to $\frac{D\delta}{DV}$; that is, of $\frac{BC}{BV}$ to $\frac{DC}{DV}$: that is, of $\frac{\text{fin. incid.}}{\text{cof. incid.}} \cdot \frac{\text{fin. refr.}}{\text{cof. refr.}}$; that is, of *tan. incid.* to *tan. refr.*

*Corollary.* The difference of these variations is to the greatest or least of them as the difference of the tangents to the greatest or least tangent.

## PROBLEM.

Plate CCLV.

Let two rays RV, RP diverge from, or converge to, a point R (figs. 1, 2, 3, 4.), and pass through the plane surface PV separating two refracting mediums AB, of which let B be the most refracting, and let RV be perpendicular to the surface. It is required to determine the point of dispersion or convergence, F, of the refracted rays VD, PE.

Make VR to VG as the sine of refraction to the sine of incidence, and draw GIK parallel to the surface, cutting the incident ray in I. About the centre P, with the radius PI, describe an arch of a circle IF, cutting VR in F; draw PE tending from or towards F. We say PE is the refracted ray, and F the point of dispersion or convergence of the rays RV, RP, or the conjugate focus to R.

For since GI and PV are parallel and PF equal to PI, we have PF : PR=PI : PR,=VG : VR,=sin. incid. : sin. refr. But PF : PR=sin. PRV : sin. PFV, and RRV is equal to the angle of incidence at P; therefore PFV is the corresponding angle of refraction, FPE is the refracted ray, and F the conjugate focus to R.

Cause of Refraction.

*Corol.* 1. If diverging or converging rays fall on the surface of a more refracting medium, they will diverge or converge less after refraction, F being farther from the surface than R. The contrary must happen when the diverging or converging rays fall on the surface of a less refracting medium, because, in this case, F is nearer to the surface than R.

*Corol.* 2. Let R$p$ be another ray, more oblique than RP, the refracting point $p$ being farther from V, and let $fpe$ be the refracted ray, determined by the same construction. Because the arches FI, $fi$, are perpendicular to their radii, it is evident that they will converge to some point within the angle RIK, and therefore will not cross each other between F and I: therefore R$f$ will be greater than RF, as RF is greater than RG, for similar reasons. Hence it follows, that all the rays which tended from or towards R, and were incident on the whole of VP$p$, will not diverge from or converge to F, but will be diffused over the line GF$f$. This diffusion is called aberration from the focus, and is so much greater as the rays are more oblique. No rays flowing from or towards R will have point of concourse with RV nearer to R than F is: But if the obliquity be inconsiderable, so that the ratio of RP to FP does not differ sensibly from that of RV to FV, the point of concourse will not be sensibly removed from G. G is therefore usually called the *conjugate focus* to R. It is the conjugate focus of an indefinitely slender pencil of rays falling perpendicularly on the surface. The conjugate focus of an oblique pencil, or even of two oblique rays, whose dispersion on the surface is considerable, is of more difficult investigation. See *Gravesande's Natural Philosophy* for a very neat and elementary determination (E).

In a work of this kind, it is enough to have pointed out, in an easy and familiar manner, the nature of optical aberration. But as this is the chief cause of the imperfection of optical instruments, and as the only method of removing this imperfection is to diminish this aberration, or correct it by a subsequent aberration in the opposite direction, we shall here give a fundamental and very simple proposition, which will (with obvious alterations) apply to all important cases. This is the determination of the focus of an infinitely slender pencil of oblique rays RP, R$p$.

"Retaining the former constructions for the ray PF, (fig. 1.) suppose the other ray R$p$ infinitely near to RP. Draw PS perpendicular to PV, and R$r$ perpendicular to RP, and make P$r$ : PS=VR : VF. On P$r$ describe the semicircle $r$RP, and on PS the semicircle S$\varphi$P, cutting the refracted ray PF in $\varphi$, draw $pr$, $p$S, $p\varphi$." It follows

(E) We refer to Gravesande, because we consider it as of importance to make such a work as ours serve as a general index to science and literature. At the same time we take the liberty to observe, that the focus in question is virtually determined by the construction which we have given: for the points P, F of the line PF are determined, and therefore its position is also determined. The same is true of the position of $pf$, and therefore the intersection $\varphi$ of the two lines is likewise determined.

follows from the lemma, that if $\varphi$ be the focus of refracted rays, the variation $P\varphi p$ of the angle of refraction is to the corresponding variation $PRp$ of the angle of incidence as the tangent of the angle of refraction VFP to the tangent of the angle of incidence VRP. Now $Pp$ may be considered as coinciding with the arch of the semicircles. Therefore the angles $PRp$, $Prp$ are equal, as also the angles $P\varphi p$, $PSp$. But $PSp$ is to $Prp$ as $Pr$ to PS; that is, as VR to VF; that is, as the cotangent of the angle of incidence to the cotangent of the angle of refraction; that is, as the tangent of the angle of refraction to the tangent of the angle of incidence. Therefore the point $\varphi$ is the focus.

### *Of Refraction by Spherical Surfaces.*

#### General Problem.

To find the focus of refracted rays, the focus of incident rays being given.

Plate CCCLV.

Let $PV\pi$ (figs. 5, 6, 7, 8, 9, 10, 11, 12, 13, 14,) be a spherical surface whose centre is C, and let the incident light diverge from or converge to R.

*Solution.* Draw the ray RC through the centre, cutting the surface in the point V, which we shall denominate the *vertex*, while RC is called the *axis*. This ray passes on without refraction, because it coincides with the perpendicular to the surface. Let RP be another incident ray, which is refracted at P, draw the radius PC. In RP make RE to RP as the sine of incidence $m$ to the sine of refraction $n$; and about the centre R, with the distance RE, describe the circle EK, cutting PC in K; draw RK and PF parallel to it, cutting the axis in F. PF is the refracted ray, and F is the focus.

141 The focus of rays refracted by spherical surfaces ascertained.

For the triangles PCF, KCR are similar, and the angles at P and K are equal. Also RK is equal to RE, and RPD is the angle of incidence. Now $m:n=RK:RP,=$ sin. DPR : sin. RKP, = sin. DPR : sin. CPF. Therefore CPF is the angle of refraction corresponding to the angle of incidence RPD, and PF is the refracted ray, and F the focus. Q. E. D.

*Cor.* 1. $CK:CP=CR:CF$, and $CF=\dfrac{CP\times CR}{CK}$; Now $CP\times CR$ is a constant quantity; and therefore CF is reciprocally as CK, which evidently varies with a variation of the arch VP. Hence it follows, that all the rays flowing from R are not collected as the conjugate focus F. The ultimate situation of the point F, as the point P gradually approaches to, and at last coincides with, V, is called *the conjugate focus of central rays*, and the distance between this focus and the focus of a lateral ray is called *the aberration* of that ray, arising from the spherical figure.

There are, however, two situations of the point R such, that all the rays which flow from it are made to diverge from one point. One of those is C (fig. 5.), because they all pass through without refraction, and therefore still diverge from C; the other is when rays in the rare medium with a convex surface flow from a point R, so situated beyond the centre that CV is to CR as the sine of incidence in the rare medium is to the sine of refraction in the denser, or when rays in the rare medium fall on the convex surface of the denser, converging to F, so situated that $CF:CV=m:n$. In this case they will all be dispersed from F, so situated that $CV:CF=n:m,=CR:CV$ for sine RPC : sine RKC $=n:m,=CR:CP,=$ sine RPC : sine PRC. Therefore the angle PRC is equal to RKC, or to FPC (by construction of the problem), and the angle C is common to the triangles PRC, FPC; they are therefore similar, and the angles PRC, FPC are equal, and $n:m=CP:CF,=CK:CR,=CR:CP$; therefore $CP:CK=CP^2:CR^2$: but CP and CR are constant quantities, and therefore CK is a constant quantity, and (by the corollary) CF is a constant quantity, and all the rays flowing from R are dispersed from F by refraction. In like manner rays converging to F will by refraction converge to R. This was first observed by Huygens.

2. If the incident ray R'P (fig. 5.) is parallel to the axis RC, we have PO to CO as the sine of incidence to the sine of refraction. For the triangles R' PK' PCO are similar, and $PO:CO=R'K':R'P,=m:n$.

3. In this case, too, we have the focal distance of central parallel rays reckoned from the vertex $=\dfrac{m}{m-n}\times VC$. For since PO is ultimately VO, we have $m:n=VO:CO$, and $m-n:m=VO-CO:VO,=VC:VO$, and $VO=\dfrac{m}{m-n}\times VC$. This is called the principal focal distance, or focal distance of parallel rays. Also CO, the principal focal distance reckoned from the centre, $=\dfrac{n}{m-n}\times VC$.

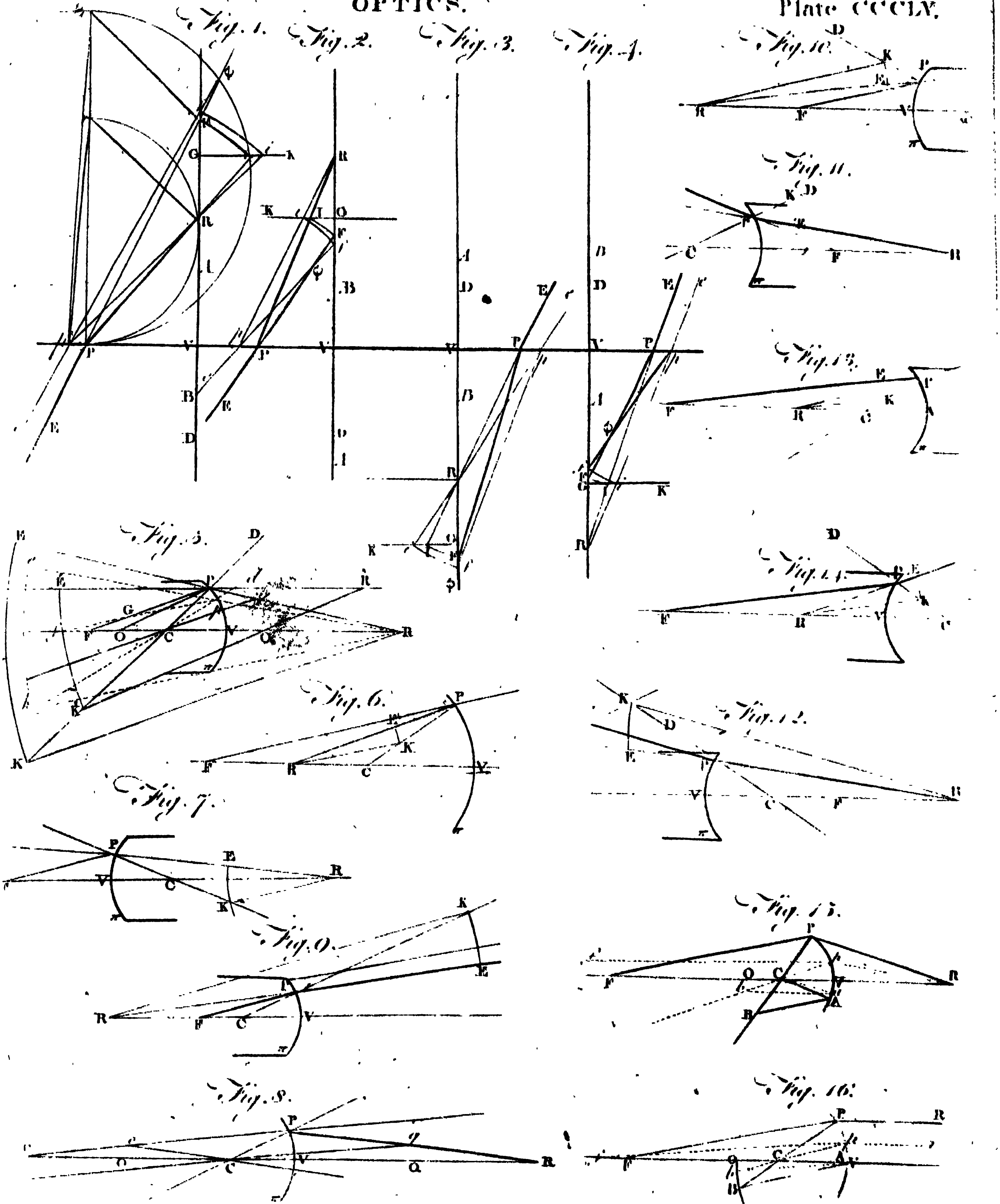
*N. B.* When $m$ is less that $n$, $m-n$ is a negative quantity.—Also observe, that in applying symbols to this computation of the focal distances, those lines are to be accounted positive which lie from their beginnings, that is, from the vertex, or the centre, or the radiant point, in the direction of the incident rays. Thus when rays diverge from R on the convex surface of a medium, VR is accounted negative and VC positive. If the light passes out of air into glass, $m$ is greater than $n$; but if it passes out of glass into air, $m$ is less than $n$. If, therefore, parallel rays fall on the convex surface of glass out of air, in which case $m:n=3:2$ very nearly, we have for the principal focal distance $\dfrac{3}{3-2}VC$, or $+3VC$. But if it pass out of glass into the convex surface of air, we have $VO=\dfrac{2}{2-3}VC$, or $-2VC$; that is, the focus O will be in the same side of the surface with the incident light. In like manner, we shall have for these two cases $CO=+2VC$ and $-3VC$.

4. By construction we have $RK:RP=m:n$

| | |
|---|---|
| by similarity of triangles | $PF:RK=CF:CR$ |
| therefore | $PF:PR=mCF:nCR$ |
| and | $mPR\times CF=nCR\times PF$ |
| therefore | $mPR:nCR=PF:CF$ |
| and | $mPR-nCR:mPR=PF-CF:PF$ |
| ultimately | $mVR-nCR:mVR=VC:VF$ |

This is a very general optical theorem, and affords an easy method for computing the focal distance of refracted rays.

For this purpose let VR, the distance of the radiant point,




A. Bell Prin. Pal. Sculptor fecit.

Refraction by Spherical Surfaces.

point, be expressed by the symbol $r$, the distance of the focus of refracted rays by the symbol $f$, and the radius of the spherical surface by $a$; we have

$$mr-n\overline{r-a} : mr = a : f, \text{ and}$$

$$f = - \qquad mr-n\,\overline{r-a} \qquad m-nr+nd$$

In its application due attention must be paid to the qualities of $r$ and $a$, whether they be positive or negative, according to the conditions of last corollary.

Plate CCCLV.

5. If Q (fig. 8.) be the focus of parallel rays coming from the opposite side, we shall have RQ : QC=RV : VF. For draw C$q$ parallel to PF, cutting RP in $q$; then R$q$ : $q$C=RP : PF. Now $q$ is the focus of the parallel rays FP, C$q$. And when the point P ultimately coincides with the point V, $q$ must coincide with Q, and we have RQ : QC=RV : VF.

This is the most general optical theorem, and is equally applicable to lenses, or even to a combination of them, as to simple surfaces. It is also applicable to reflections, with this difference, that Q is to be assumed the focus of parallel rays coming the *same* way with the incident rays. It affords us the most compendious methods of computing symbolically and arithmetically the focal distances in all cases.

6. We have also R$q$ : RP=RV : RF, and ultimately for central rays RQ : RV=RV : RF, and RF= $\frac{RV^2}{RQ}$. This proposition is true in lenses and mirrors, but not in single refracting surfaces.

7. Also R$q$ : RC=RP : RF, and ultimately RQ : RV=RC : RF, and RF= $\frac{RV \times RC}{RQ}$. *N. B.* These four points Q, V, C, F, either lie all one way from R, or two of them forward and two backward.

8. Also, making O the principal focus of rays coming the same way, we have R$q$ : $q$C=C$o$ : $o$F, and ultimately RQ : Q$c$=$c$O : OF, and OF= $\frac{QC \times CO}{RQ}$, and therefore reciprocally proportional to RQ, because QC$\times co$ is a constant quantity.

These corollaries or theorems give us a variety of methods for finding the focus of refracted rays, or the other points related to them; and each formula contains four points, of which any three being given the fourth may be found. Perhaps the last is the most simple, as the quantity $oc+c$Q is always negative, because $o$ and Q are on different sides.

9. From this construction we may also derive a very easy and expeditious method of drawing many refracted rays. Draw through the centre C (fig. 15. 16.) a line to the point of incidence P, and a line CA parallel to the incident ray RP. Take VO to VC as the sine of incidence to the sine of refraction, and about A, with the radius VO, describe an arch of a circle cutting PC produced in B. Join AB: and PF parallel to AB is the refracted ray. When the incident light is parallel to RC, the point A coincides with V, and a circle described round V with the distance VO will cut the lines PC, $p$C, &c. in the points B$b$. The demonstration is evident.

Having thus determined the focal distance of refracted rays, it will be proper to point out a little more particularly its relation to its conjugate focus of incident rays. We shall consider the four cases of light incident on the convex or concave surface of a denser or a rarer medium.

Refraction by Spherical Surfaces.

1. Let light moving in air fall on the convex surface of glass (fig. 5. to fig. 14.). Let us suppose it tending to a point beyond the glass infinitely distant. It will be collected to its principal focus $o$ beyond the vertex V. Now let the incident light converge a little, so that R is at a great distance beyond the surface. The focus of refracted rays F will be a little within O or nearer to V. As the incident rays are made to converge more and more, the point R comes nearer to V, and the point F also approaches it, but with a much slower motion, being always situated between O and C till it is overtaken by R at the centre C, when the incident light is perpendicular to the surface in every point, and therefore suffers no refraction. As R has overtaken F at C, it now passes it, and is again overtaken by it at V. Now the point R is on the side from which the light comes, that is, the rays diverge from R. After refraction they will diverge from F a little without R; and as R recedes farther from V, F recedes still farther, and with an accelerated motion, till, when R comes to Q, F has gone to an infinite distance, or the refracted rays are parallel. When R still recedes, F now appears on the other side, or beyond V; and as R recedes back to an infinite distance, F has come to O: and this completes the series of variations, the motion of F during the whole changes of situation being in the same direction with the motion of R.

2. Let the light moving in air fall on the concave surface of glass; and let us begin with parallel incident rays, conceiving, as before, R to lie beyond the glass at an infinite distance. The refracted rays will move as if they came from the principal focus O, lying on that side of the glass from which the light comes. As the incident rays are made gradually more converging, and the point of convergence R comes toward the glass, the conjugate focus F moves backward from O; the refracted rays growing less and less diverging, till the point R comes to Q, the principal focus on the other side. The refracted rays are now parallel, or F has retreated to an infinite distance. The incident light converging still more, or R coming between Q and V, F will appear on the other side, or beyond the surface, or within the glass, and will approach it with a retarded motion, and finally overtake R at the surface of the glass. Let R continue its motion backwards (for it has all the while been moving backwards, or in a direction contrary to that of the light); that is, let R now be a radiant point, moving backwards from the surface of the glass. F will at first be without it, but will be overtaken by it at the centre C, when the rays will suffer no refraction. R still receding will get without F; and while R recedes to an infinite distance, F will recede to O, and the series will be completed.

3. Let the light moving in glass fall on the convex surface of air; that is, let it come out of the concave surface of glass, and let the incident rays be parallel, or tending to R, infinitely distant: they will be dispersed by refraction from the principal focus O within the glass. As they are made more converging, R comes nearer, and F retreats backward, till R comes

Of Glasses.

to Q, the principal focus without the glass; when F is now at an infinite distance within the glass, and the refracted rays are parallel. R still coming nearer, F now appears before the glass, overtakes R at the centre C, and is again overtaken by it at V. R now becoming a radiant point within the glass, F follows it backwards, and arrives at O, when R has receded to an infinite distance, and the series is completed.

4. Let the incident light, moving in glass, fall on the concave surface of air, or come out of the convex surface of glass. Let it tend to a point R at an infinite distance without the glass. The refracted rays will converge to O, the principal focus without the glass. As the incident light is made more converging, R comes towards the glass, while F, setting out from *v*, also approaches the glass, and R overtakes it at the surface V. R now becomes a radiant point within the glass, receding backwards from the surface. F recedes slower at first, but overtakes R at the centre C, and passes it with an accelerated motion to an infinite distance; while R retreats to Q, the principal focus within the glass. R still retreating, F appears before the glass; and while R retreats to an infinite distance, F comes to V, and the series is completed.

### § 2. *Of Glasses.*

142 Lenses how many. Glass for optical purposes may be ground into nine different shapes. Glasses cut into five of those shapes are called *lenses*, which together with their axes are described in Vol. VI. page 33. (See DIOPTRICS). The other four are,

Plate CCCLVI. 1. A *plane glass*, which is flat on both sides, and of equal thickness in all its parts, as EF, fig. 1.

2. A *flat plano-convex*, whose convex side is ground into several little flat surfaces, as A, fig. 2.

3. A *prism*, which has three flat sides, and when viewed endwise appears like an equilateral triangle, as B.

4. A *concavo-convex* glass, as C, which has hitherto received no name, and is seldom, if ever, made use of in optical instruments.

A ray of light G*h* (fig. 1.) falling perpendicularly on a plane glass EF, will pass through the glass in the same direction *hi*, and go out of it into the air in the same straight line *i* H.

A ray of light AB falling obliquely on a plane glass, will go out of the glass in the same direction, but not in the same straight line; for in touching the glass, it will be refracted in the line BC; and in leaving the glass, it will be refracted in the line CD.

Fig. 3. to 6. *Lemma.* There is a certain point E within every double convex or double concave lens, through which every ray that passes will have its incident and emergent parts QA, *aq* parallel to each other: but in a plano-convex or plano-concave lens, that point E is removed to the vertex of the concave or convex surface; and in a meniscus, and in that other concavo-convex lens, it is removed a little way out of them, and lies next to the surface which has the greatest curvature.

For let RE*r* be the axis of the lens joining the centres R, *r* of its surfaces A, *a*. Draw any two of their semidiameters RA, *ra* parallel to each other, and join the point, A, *a*, and the line A*a* will cut the axis in the point E above described. For the triangles REA, *rEa* being equiangular, RE will be to E*r* in the given ratio of the semidiameters RA, *ra*; and consequently the point E is invariable in the same lens. Now supposing a ray to pass both ways along the line A*a*, it being equally inclined to the perpendiculars to the surfaces, will be equally bent, and contrariwise in going out of the lens; so that its emergent parts AQ, *aq* will be parallel. Now any of these lenses will become plano-convex or plano-concave, by conceiving one of the semidiameters RA, *ra* to become infinite, and consequently to become parallel to the axis of the lens, and then the other semidiameter will coincide with the axis; and so the points A, E or *a*, E will coincide. Q. E. D.

*Corol.* Hence when a pencil of rays falls almost perpendicularly upon any lens, whose thickness is inconsiderable, the course of the ray which passes through E, above described, may be taken for a straight line passing through the centre of the lens without sensible error in sensible things. For it is manifest from the length of A*a*, and from the quantity of the refractions at its extremities, that the perpendicular distance of AQ, *aq* when produced, will be diminished both as the thickness of the lens and the obliquity of the ray is diminished.

## PROPOSITION I.

To find the focus of parallel rays falling almost perpendicularly upon any given lens.

Let E be the centre of the lens, and *r* the centres of its surfaces, R*r* its axis, *g*EG a line parallel to the incident rays upon the surface B, whose centre is R. Parallel to *g*E draw a semidiameter BR, in which produced let V be the focus of the rays after their first refraction at the surface B, and joining V*r* let it cut *g*E produced in G, and G will be the focus of the rays that emerge from the lens. Fig. 7. to 12. 143 The focus of parallel rays falling perpendicularly upon any lens.

For since V is also the focus of the rays incident upon the second surface A, the emergent rays must have their focus in some point of that ray which passes straight through this surface; that is, in the line V*r*, drawn through its centre *r*: and since the whole course of another ray is reckoned a straight line *g*EG ‡, its intersection G with V*r* determines the focus of them all. Q. E. D.

‡ Corol. from Lemma.

*Corol.* 1. When the incident rays are parallel to the axis *r*R, the focal distance EF is equal to EG. For let the incident rays that were parallel to *g*E be gradually more inclined to the axis till they become parallel to it; and their first and second focuses V and G will describe circular arches VT and GF whose centres are R and E. For the line RV is invariable; being in proportion to RB in a given ratio of the lesser of the sines of incidence and refraction to their difference §; consequently the line EG is also invariable, being in proportion to the given line RV in the given ratio of *r*E to *r*R, because the triangles EG*r*, RV*r* are equiangular.

§ By a former Prop.

*Corol.* 2. The last proportion gives the following rule for finding the focal distance of any thin lens. As R*r*, the interval between the centres of the surfaces, is to *r*E, the semidiameter of the second surface, so is RV or RT, the continuation of the first semidiameter to the first focus, to EG or EF the focal distance of the lens; which, according as the lens is thicker or thinner in the middle than at its edges, must lie on the

the same side as the emergent rays, or on the opposite side.

*Corol.* 3. Hence when rays fall parallel on both sides of any lens, the focal distances EF, E$f$ are equal. For let $rt$ be the continuation of the semidiameter E$r$ to the first focus $t$ of rays falling parallel upon the surface A; and the same rule that gave $r$R to $r$E as RT to EF, gives also $r$R to RE as $rt$ to E$f$. Whence E$f$ and EF are equal, because the rectangles under $r$E, RT and also under RE, $rt$ are equal. For $r$E is to $rt$ and also RE to RT in the same given ratio.

*Corol.* 4. Hence in particular in a double convex or double concave lens made of glass, it is as the sum of their semidiameters (or in a meniscus as their difference) to either of them, so is double the other, to the focal distance of the glass. For the continuations RT, $rt$ are severally double their semidiameters: because in glass ET is to TR and also E$t$ to $tr$ as 3 to 2.

*Corol.* 5. Hence if the semidiameters of the surfaces of the glass be equal, its focal distance is equal to one of them; and is equal to the focal distance of a plano-convex or plano-concave glass whose semidiameter is as short again. For considering the plane surface as having an infinite semidiameter, the first ratio of the last mentioned proportion may be reckoned a ratio of equality.

## PROPOSITION II.

144 The focus of emergent rays found.

The focus of incident rays upon a single surface, sphere, or lens, being given, it is required to find the focus of the emergent rays.

Plate CCCLVII. fig. 1. to 6.

Let any point Q be the focus of incident rays upon a spherical surface, lens, or sphere, whose centre is E; and let other rays come parallel to the line QE$q$ the contrary way to the given rays, and after refraction let them belong to a focus F; then taking E$f$ equal to EF in the lens or sphere, but equal to FC in the single surface, say as QF to FE so E$f$ to $fq$; and placing $fq$ the contrary way from $f$ to that of FQ from F, the point $q$ will be the focus of the refracted rays, without sensible error; provided the point Q be not so remote from the axis, nor the surfaces so broad as to cause any of the rays to fall too obliquely upon them.

For with the centre E and semidiameters EF and E$f$ describe two arches FG, $fg$ cutting any ray QA$aq$ in G and $g$, and draw EG and E$g$. Then supposing G to be a focus of incident rays (as GA), the emergent rays (as $agq$) will be parallel to GE†; and on the other hand supposing $g$ another focus of incident rays (as $ga$), the emergent rays (as AGQ) will be parallel to $g$E. Therefore the triangles QGE, E$gq$ are equiangular, and consequently QG is to GE as E$g$ to $gq$; that is, when the ray QA$aq$ is the nearest to QE$q$, QF is to FE as E$f$ to $fg$. Now when Q accedes to F and coincides with it, the emergent rays become parallel, that is, $q$ recedes to an infinite distance; and consequently when Q passes to the other side of F, the focus $q$ will also pass through an infinite space from one side of $f$ to the other side of it. Q. E. D.

† By Corol. from former Prop.

*Corol.* 1. In a sphere or lens the focus $q$ may be found by this rule: As QF to QE so QE to Q$q$, to be placed the same way from Q as QF lies from Q.—For let the incident and emergent ray QA, $qa$ be produced till they meet in $e$; and the triangles QGE, Q$eq$ being equiangular, we have QG to QE as Q$e$ to Q$q$; and when the angles of these triangles are vanishing, the point $e$ will coincide with E; because in the sphere the triangle A$ea$ is equiangular at the base A$a$, and consequently A$e$ and $ae$ will at last become semidiameters of the sphere. In a lens the thickness A$a$ is inconsiderable.

The focus may also be found by this rule;—QF : FE : : QE : E$q$, for QG : GE : : QA : A$q$.—And then the rule formerly demonstrated for single surfaces holds good for the lenses.

*Corol.* 2. In all cases the distance $fq$ varies reciprocally as FQ does; and they lie contrariwise from $f$ and F; because the rectangle or the square under EF and E$f$, the middle terms in the foregoing proportions, is invariable.

The principal focal distance of a lens may not only be found by collecting the rays coming from the sun, considered as parallel, but also (by means of this proposition) it may be found by the light of a candle or window. For, because Q$q$ : $q$A : : QE : EG, we have (when A coincides with E) Q$q$ : $q$E = QE : EF; that is, the distance observed between the radiant object and its picture in the focus is to the distance of the lens from the focus as the distance of the lens from the radiant is to its principal focal distance. Multiply therefore the distances of the lens from the radiant and focus, and divide the product by their sum.

*Corol.* 3. Convex lenses of different shapes that have equal focal distances, when put into each others places, have equal powers upon any pencil of rays to refract them to the same focus. Because the rules abovementioned depend only upon the focal distance of the lens, and not upon the proportion of the semidiameters of its surfaces.

*Corol.* 4. The rule that was given for a sphere of an uniform density, will serve also for finding the focus of a pencil of rays refracted through any number of concentric surfaces, which intercede uniform mediums of any different densities. For when rays come parallel to any line drawn through the common centre of these mediums, and are refracted through them all, the distance of their focus from that centre is invariable, as in an uniform sphere.

*Corol.* 5. When the focuses Q, $q$ lie on the same side of the refracting surfaces, if the incident rays flow from Q, the refracted rays will also flow from $q$; and if the incident rays flow towards Q, the refracted will also flow towards $q$: and the contrary will happen when Q and $q$ are on contrary sides of the refracting surfaces. Because the rays are continually going forwards.

From this proposition we also derive an easy method of drawing the progress of rays through any number of lenses ranged on a common axis.

Let A, B, C, (fig. 7.) be the lenses, and RA a ray incident on the first of them. Let $\alpha$, $\beta$, $\kappa$, be their foci for parallel rays coming in the opposite direction; draw the perpendicular $a\,d$, cutting the incident ray in $d$, and draw $d\,a$ through the centre of the lens: AB parallel to $d\,a$ will be the ray refracted by the first lens. Through the focus of the second lens draw the perpendicular $\beta\,e$, cutting AB in

Of Vision. *e*; and draw *e b* through the centre of the second lens. BD parallel to *b e* will be the next refracted ray. Through the focus *x* of the third lens draw the perpendicular *xf*, cutting BD in *f*, and draw *f c* through the centre of the third lens. CE parallel to *f c*, will be the refracted ray; and so on.

## § 3. *Of Vision.*

Having described how the rays of light, flowing from objects, and passing through convex glasses, are collected into points, and form the images of the objects; it will be easy to understand how the rays are affected by passing through the humours of the eye, and are thereby collected into innumerable points on the bottom of the eye, and thereon form the images of the objects which they flow from. For the different humours of the eye, and particularly the crystalline humour, are to be considered as a convex glass; and the rays in passing through them to be affected in the same manner as in passing through a convex glass. A description of the coats and humours, &c. has been given at large in ANATOMY; but for the reader's convenience in this place, we shall repeat in a few words as much of the description as will be sufficient for our present purpose.

Plate CCCLVII. fig. 8.

145 Description of the eye.

The eye is nearly globular. It consists of three coats and three humours. The part DHHG of the outer coat, is called the *sclerotica*; the rest, DEFG, the *cornea*. Next within this coat is that called the *choroides*, which serves as it were for a lining to the other, and joins with the iris, *m n*, *m n*. The iris is composed of two sets of muscular fibres; the one of a circular form, which contracts the hole in the middle called the *pupil*, when the light would otherwise be too strong for the eye; and the other of radical fibres, tending everywhere from the circumference of the iris towards the middle of the pupil; which fibres, by their contraction, dilate and enlarge the pupil when the light is weak, in order to let in the more of its rays. The third coat is only a fine expansion of the optic nerve L, which spreads like net work all over the inside of the choroides, and is therefore called the *retina*; upon which are painted (as it were) the images of all visible objects, by the rays of light which either flow or are reflected from them.

Under the cornea is a fine transparent fluid like water, which is therefore called the *aqueous humour*. It gives a protuberant figure to the cornea, fills the two cavities *m m* and *n n*, which communicate by the pupil P; and has the same limpidity, specific gravity, and refractive power, as water. At the back of this lies the crystalline humour II, which is shaped like a double convex glass; and is a little more convex on the back than the fore part. It converges the rays, which pass through it from every visible object to its focus at the bottom of the eye. This humour is transparent like crystal, is much of the consistence of hard jelly, and exceeds the specific gravity of water in the proportion of 11 to 10. It is enclosed in a fine transparent membrane, from which proceed radial fibres *o o*, called the *ligamentum ciliare* all around its edge; and join to the circumference of the iris.

At the back of the crystalline, lies the vitreous humour KK, which is transparent like glass, and is largest of all in quantity, filling the whole orb of the eye, and giving it a globular shape. It is much of a consistence with the white of an egg, and very little exceeds the specific gravity and refractive power of water.

146 The objects on the retina of the eye are inverted.

As every point of an object ABC, (*ibid.*) sends out rays in all directions, some rays, from every point on the side next the eye, will fall upon the cornea between E and F; and by passing on through the humours and pupil of the eye, they will be converged to as many points on the retina or bottom of the eye, and will thereon form a distinct inverted picture *c b a*, of the object. Thus, the pencil of rays *q r s* that flows from the point A of the object, will be converged to the point *a* on the retina; those from the point B will be converged to the point *b*; those from the point C will be converged to the point *c*; and so of all the intermediate points: by which means the whole image *a b c* is formed, and the object made visible. Although it must be owned, that the method by which this sensation is carried from the eye by the optic nerve to the common sensory in the brain, and there discerned, is above the reach of our comprehension.

But that vision is effected in this manner, may be demonstrated experimentally. Take a bullock's eye whilst it is fresh; and having cut off the three coats from the back part, quite to the vitreous humour, put a piece of white paper over that part, and hold the eye towards any bright object, and you will see an inverted picture of the object upon the paper.

147 Why they are seen upright.

Since the image is inverted, many have wondered why the object appears upright. But we are to consider, 1. That *inverted* is only a relative term: and, 2. That there is a very great difference between the real object and the means or image by which we perceive it. When all the parts of a distant prospect are painted upon the retina, they are all right with respect to one another, as well as the parts of the prospect itself; and we can only judge of an object's being inverted, when it is turned reverse to its natural position with respect to other objects which we see and compare it with.—If we lay hold of an upright stick in the dark, we can tell which is the upper or lower part of it, by moving our hand downward or upward; and know very well that we cannot feel the upper end by moving our hand downward. Just so we find by experience, that upon directing our eyes towards a tall object, we cannot see its top by turning our eyes downward, nor its foot by turning our eyes upward; but must trace the object the same way by the eye to see it from head to foot, as we do by the hand to feel it; and as the judgment is informed by the motion of the hand in one case, so it is also by the motion of the eye in the other.

In fig. 9. is exhibited the manner of seeing the same object ABC, by both the eyes D and E at once.

148 An object when viewed with both eyes does not appear double, because the optic nerve is insensible of light.

When any part of the image *c b a* falls upon the optic nerve L, the corresponding part of the object becomes invisible. On which account, nature has wisely placed the optic nerve of each eye, not in the middle of the bottom of the eye, but towards the side next the nose; so that whatever part of the image falls upon the optic nerve of one eye, may not fall upon the optic nerve of the other. Thus the point *a* of the image

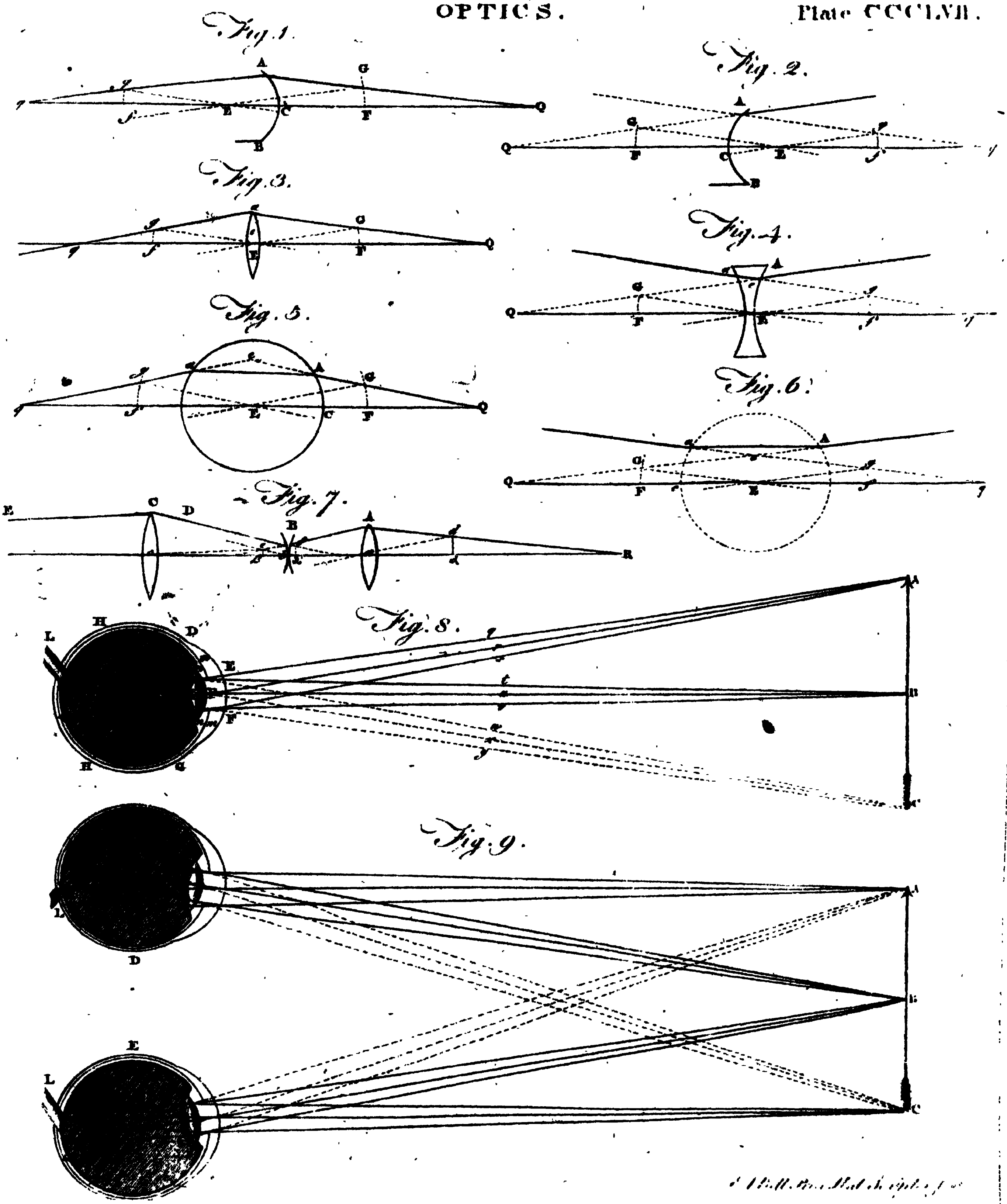


Fig. 1.
A G Q q E C F B
Fig. 2.
A G Q F C E B q
Fig. 3.
G Q q F E
Fig. 4.
A G Q F E q
Fig. 5.
A G Q q E C F
Fig. 6.
A G Q F E q
Fig. 7.
E C D B A R
Fig. 8.
L H D E F H G A B C
Fig. 9.
L D E L A B C

image *c b a* falls upon the optic nerve of the eye D, but not of the eye E; and the point *c* falls upon the optic nerve of the eye E, but not of the eye D: and therefore, to both eyes taken together, the whole object ABC is visible.

The nearer that any object is to the eye, the larger is the angle under which it is seen, and the magnitude under which it appears. Thus to the eye D, (fig. 1.) the object ABC is seen under the angle APC; and its image *c b a* is very large upon the retina: but to the eye E, at a double distance, the same object is seen under the angle A*p*C, which is equal only to half the angle APC, as is evident by the figure. The image *c b a* is likewise twice as large in the eye D, as the other image *c b a* is in the eye E. In both these representations, a part of the image falls on the optic nerve, and the object in the corresponding part is invisible.

Plate CCCLVIII.

As the sense of seeing is allowed to be occasioned by the impulse of the rays from the visible object upon the retina of the eye, and forming the image of the object thereon, and that the retina is only the expansion of the optic nerve all over the choroides; it should seem surprising, that the part of the image which falls on the optic nerve should render the like part of the object invisible; especially as that nerve is allowed to be the instrument by which the impulse and image are conveyed to the common sensory in the brain.

149 Proved by experiment.

That the part of the image which falls upon the middle of the optic nerve is lost, and consequently the corresponding part of the object is rendered invisible, is plain by experiment. For if a person fixes three patches, A, B, C, (fig. 2.) upon a white wall, at the height of the eye, and at the distance of about a foot from each other, and places himself before them, shutting the right eye, and directing the left towards the patch C, he will see the patches A and C, but the middle patch B will disappear. Or, if he shuts his left eye, and directs the right towards A, he will see both A and C, but B will disappear; and if he directs his eye towards B, he will see both B and A, but not C. For whatever patch is directly opposite to the optic nerve N, vanishes. This requires a little practice; after which he will find it easy to direct his eye so as to lose the sight of whichever patch he pleases.

150 Dispute concerning the seat of vision.

This experiment, first tried by M. Marriotte, occasioned a new hypothesis concerning the seat of vision, which he supposed not to be in the retina, but in the choroides. An improvement was afterwards made upon it by M. Picard, who contrived that an object should disappear when both the eyes were kept open. He fastened upon a wall a round white paper, an inch or two in diameter; and by the side of it he fixed two marks, one on the right hand, and the other on the left, each at about 2 feet distance from the paper, and somewhat higher. He then placed himself directly before the paper, at the distance of 9 or 10 feet, and putting the end of his finger over against both his eyes, so that the left hand mark might be hid from the right eye, and the right hand mark from the left eye. Remaining firm in this posture, and looking steadily, with both eyes, on the end of his finger, the paper which was not at all covered by it would totally disappear. This, he says, is the more surprising, because, without this particular encounter of the optic nerves, where no vision is made, the paper will appear double, as is the case when the finger is not rightly placed.

M. Marriotte observes, that this improvement on his experiment, by M. Picard, is ingenious, but difficult to execute, since the eyes must be considerably strained in looking at any object so near to them as four inches; and proposes another not less surprising, and more easy. Place, says he, on a dark ground, two round pieces of white paper, at the same height, and three feet from one another; then place yourself opposite to them, at the distance of 12 or 13 feet, and hold your thumb before your eyes, at the distance of about eight inches, so that it may conceal from the right eye the paper that is to the left hand, and from the left eye the paper to the right hand. Then, if you look at your thumb steadily with both eyes, you will lose sight of both the papers; the eyes being so disposed, that each of them receives the image of one of the papers upon the base of the optic nerve, while the other is intercepted by the thumb.

M. Le Cat pursued this curious experiment a little farther than M. Marriotte had done. In the place of the second paper, he fixed a large white board, and observed, that at a proper distance he lost sight of a circular space in the centre of it. He also observed the size of the paper which is thus concealed from the sight, corresponding to several distances, which enabled him to ascertain several circumstances relating to this part of the structure of the eye more exactly than had been done before.

The manner in which this curious experiment is now generally made, and which is both the easiest with respect to the eye, and the most indisputable with respect to the fact, is the following. Let three pieces of paper be fastened upon the side of a room, about two feet asunder; and let a person place himself opposite to the middle paper, and, beginning near to it, retire gradually backwards, all the while keeping one of his eyes shut, and the other turned obliquely towards that outside paper which is towards the covered eye, and he will find a situation (which is generally at about five times the distance at which the papers are placed from one another), where the middle paper will entirely disappear, while the two outermost continue plainly visible; because the rays which come from the middle paper will fall upon the retina where the optic nerve is inserted.

It will not surprise any person, even those who are the strongest advocates for the retina being the place at which the pencils of rays are terminated, and consequently the proper seat of vision, that M. Marriotte was led by this remarkable observation to suspect the contrary. He not only did so; but, in consequence of attentively considering the subject, a variety of other arguments in favour of the choroides occurred to him, particularly his observation, that the retina is transparent, as well as the crystalline and other humours of the eye, which he thought could only enable it to transmit the rays farther; and he could not persuade himself that any substance could be considered as being the termination of the pencils, and the proper seat of vision, at which the rays are not stopped in their progress.

He was farther confirmed in his opinion of the small degree

degree of ſenſibility in the retina, and of the greater ſenſibility of the choroides, by obſerving that the pupil dilates itſelf in the ſhade, and contracts itſelf in a great light; which involuntary motion, he thought, was a clear proof that the fibres of the iris are extremely ſenſible to the action of light; and this part of the eye is only a continuation of the choroides. He alſo thought that the dark colour of the choroides was intended to make it more ſuſceptible of the impreſſion of light.

M. Pecquet, in anſwer to M. Marriotte's obſervation concerning the tranſparency of the retina, ſays, that it is very imperfectly ſo, reſembling only oiled paper, or the horn that is uſed for lanterns; and beſides, that its whiteneſs demonſtrates it to be ſufficiently opaque for ſtopping the rays of light, as much as is neceſſary for the purpoſe of viſion; whereas, if viſion be performed by means of thoſe rays which are tranſmitted through ſuch a ſubſtance as the retina, it muſt be very indiſtinct.

As to the blackneſs of the choroides, which M. Marriotte thought to be neceſſary for the purpoſe of viſion, M. Pecquet obſerves, that it is not the ſame in all eyes, and that there are very different ſhades of it among the individuals of mankind, as alſo among birds, and ſome other animals, whoſe choroides is generally black; and that in the eyes of lions, camels, bears, oxen, ſtags, ſheep, dogs, cats, and many other animals, that part of the choroides which is the moſt expoſed to light, very often exhibits colours as vivid as thoſe of mother-of-pearl, or of the iris (F). He admits that there is a defect of viſion at the inſertion of the optic nerve; but he thought that it was owing to the blood veſſels of the retina, the trunks of which are ſo large in that place as to obſtruct all viſion.

To M. Pecquet's objection, founded on the opacity of the retina, M. Marriotte obſerves, that there muſt be a great difference betwixt the ſtate of that ſubſtance in living and dead ſubjects; and as a further proof of the tranſparency of the retina, and the power of the choroides beyond it to reflect light, he ſays, that if a lighted candle be held near to a perſon's eyes, and a dog, at the diſtance of eight or ten ſteps, be made to look at him, he would ſee a bright light in the dog's eyes, which he thought to proceed from the reflection of the light of the candle from the choroides of the dog, ſince the ſame appearance cannot be produced in the eyes of men, or other animals, whoſe choroides is black.

To M. Pecquet's remark concerning the blood veſſels of the retina, M. Marriotte obſerves, that they are not large enough to prevent viſion in every part of the baſe of the nerve, ſince the diameter of each of the two veſſels occupies no more than $\frac{1}{8}$th part of it. Beſides, if this were the cauſe of this want of viſion, it would vaniſh gradually, and the ſpace to which it is confined would not be ſo exactly terminated as it appears to be.

We muſt add, that M. Pecquet alſo obſerved, that notwithſtanding the inſenſibility of the retina at the inſertion of the optic nerve when the light is only moderate; yet that luminous objects, ſuch as a bright candle placed at the diſtance of four or five paces, do not abſolutely diſappear, in the ſame circumſtances in which a white paper would; for that this ſtrong light may be perceived though the picture fall on the baſe of the nerve. "I cannot help ſuſpecting, however, (ſays Dr Prieſtley), that M. Pecquet did not make this obſervation with ſufficient care. A large candle makes no impreſſion on that part of my eye, though it is by no means able to bear a ſtrong light."

The common opinion was alſo favoured by the anatomical deſcription of ſeveral animals by the members of the French academy, and particularly their account of the ſea calf and porcupine; in both of which the optic nerve is inſerted in the very axis of the eye, exactly oppoſite to the pupil, which was thought to leave no room to doubt, but that in theſe animals the retina is perfectly ſenſible to the impreſſion of light at the inſertion of the nerve. But this obſervation may deſerve to be reconſidered.

M. De la Hire took part with M. Pecquet, arguing in favour of the retina from the analogy of the ſenſes, in all of which the nerves are the proper ſeat of ſenſation. This philoſopher, however, ſuppoſed that the choroides receives the impreſſions of images, in order to tranſmit them to the retina.

M. Perrault alſo took the part of M. Pecquet againſt M. Marriotte, and in M. Perrault's works we have ſeveral letters that paſſed between theſe two gentlemen upon this ſubject.

This diſpute about the immediate inſtrument of viſion was revived upon the occaſion of an odd experiment of M. Mery, recorded in the Memoirs of the French Academy for 1704. He plunged a cat in water, and expoſing her eye to the ſtrong light of the ſun, obſerved that the pupil was not at all contracted by it; from which he concluded, that the contraction of the iris is not produced by the action of the light, but by ſome other circumſtance. For he contended that the eye receives more light in this ſituation than in the open air. At the ſame time he thought he obſerved that the retina of the cat's eye was tranſparent, and that he could ſee the opaque choroides beyond it: from which he concludes, that the choroides is the ſubſtance intended to receive the rays of light, and to be the chief inſtrument of viſion. But M. De la Hire replies to this argument of M. Mery, in a memoir for the year 1709, p. 119; in which he endeavours to ſhow that fewer rays enter the eye under water, and that in thoſe circumſtances it is not ſo liable to be affected by them. Beſides, it is obvious to be remarked, that the cat muſt be in great terror in this ſituation; and being an animal that has a very great voluntary power over the muſcles of the iris, and being now extremely attentive to every thing about her, ſhe might keep her eye open notwith-

ſtanding

(F) M. Muſſchenbroek ſays, that in many animals, as the lion, camel, bear, ox, ſtag, ſheep, dog, cat, and many birds, the choroides is not black, but blue, green, yellow, or ſome other colour. *Introductio*, Vol. II. p. 748.

standing the action of the light upon it, and though it might be very painful to her. We are informed, that when a cat is placed in a window through which the sun is shining, and consequently her iris nearly closed, if she hear a rustling, like that which is made by a mouse, on the outside of the window, she will immediately open her eyes to their greatest extent, without in the least turning her face from the light.

M. Le Cat took part with M. Marriotte in this controversy, it being peculiarly agreeable to his general hypothesis, viz. that the pia mater, of which the choroides is a production, and not the nerves themselves, is the proper instrument of sensation. He thought that the change which takes place in the eyes of old people (the choroides growing less black with age) favoured his hypothesis, as they do not see with that distinctness with which young persons do. M. Le Cat supposed that the retina answers a purpose similar to that of the scarf-skin, covering the papillæ pyramidales, which are the immediate organs of feeling, or that of the porous membrane which covers the glandulous papillæ of the tongue. The retina, he says, receives the impression of light, moderates it, and prepares it for its proper organ, but is not itself sensible of it.

It must be observed, that M. Le Cat had discovered that the pia mater, after closely embracing and constringing the optic nerve at its entrance into the eye, divides into two branches, one of which closely lines the cornea, and at length is lost in it, while the second branch makes what is called the *choroides*, or *uvea*. He also showed that the sclerotica is an expansion of the dura mater; and he sent dissections of the eye to the Royal Academy of Sciences in 1739, to prove these assertions, and several others which he had advanced in his *Traité de Sens*, that were contrary to the opinions of the celebrated Winslow.

To these arguments in favour of the choroides, alleged by those gentlemen among whom the subject was first discussed, Dr Priestley in his history adds the following that had escaped their notice, but which were suggested to him by his friend Mr Michell.

In order that vision be distinct, the pencils of rays which issue from the several points of any object, must be collected either accurately, or at least very nearly, to corresponding points in the eye, which can only be done upon some uniform surface. But the retina being of a considerable thickness, and the whole of it being uniformly nervous, and at least nearly, if not perfectly, transparent, presents no particular surface; so that, in whatever part of it the pencils be supposed to have their foci, the rays belonging to them will be separated from one another, either before or after they arrive there, and consequently vision would be confused.

If we suppose the seat of vision to be at the nearer surface of the retina, and the images of objects to be formed by direct rays, a considerable degree of confusion could not but arise from the light reflected by the choroides, in those animals in which it is white, or coloured. On the other hand, it would be impossible that vision should be performed at this place by light reflected from the choroides, because in many animals it is perfectly black, and reflects no light at all; and yet such animals see even more distinctly than others. And we cannot but suppose, that, in whatever manner vision is effected, it is the same in the eyes of all animals.

If the seat of vision be at the farther surface of the retina, and it be performed by direct rays, a white choroides could be of no use; and if it were by reflected rays, a black one could not answer the purpose.

It is likewise an argument in favour of the choroides being the organ of vision, that it is a substance which receives a more distinct impression from the rays of light than any other membrane in any part of the animal system, excepting (and perhaps not excepting) that white cuticle which lies under the scales of fishes; whereas the retina is a substance on which the light makes an exceedingly faint impression, and perhaps no impression at all; since light, in passing out of one transparent medium into another immediately contiguous to it, suffers no refraction or reflection, nor are any of the rays absorbed, unless there is some difference in the refracting power of the two media, which probably is not the case between the retina and the vitreous humour, which is in contact with it. And wherever the light is not affected by the medium it falls upon, we can hardly suppose the medium to receive any impression from the light, the action being probably always mutual and reciprocal.

Besides, the retina is so situated, as to be exposed to many rays besides those which terminate in it, and which, therefore, cannot be subservient to vision, if it be performed there. Now this is not the case with the choroides, which is in no shape transparent, and has no reflecting substance beyond it.

It is, moreover, peculiarly favourable to the hypothesis of the seat of vision being in the choroides, that we can then see a sufficient reason for the diversity of its colour in different animals, according as they are circumstanced with respect to vision. In all terrestrial animals, which have occasion to make use of their eyes by night, the choroides is either of a bright white, or of some very vivid colour, which reflects the light very strongly. On this account vision may be performed with less light, but it cannot be with great distinctness, the reflection of the rays doubling their effect, since it must extend over some space, all reflection being made at a distance from the reflecting body. Besides, the choroides in brutes is not in general perfectly white, but a little inclined to blue; and is therefore, probably, better adapted to see by the fainter coloured light, which chiefly prevails in the night; and we would add, is on the same account more liable to be strongly impressed by the colours to which they are chiefly exposed.

On the other hand, the choroides of birds in general, especially eagles, hawks, and other birds of prey, is black; by which means they are able to see with the greatest distinctness, but only in bright day light. The owl, however, seeking her food by night, has the choroides white, like that of a cat. Lastly, In the eyes of man, which are adapted to various uses, the choroides is neither so black as that of birds, nor so white as that of those animals who make the greatest use of their eyes in the night.

As to a third hypothesis, which is in effect that of M. De la Hire, which makes both the retina and the choroides equally necessary to vision, and supposes it to be performed by the impression of light on the choroides communicated

Of Vision. communicated to the retina; Mr Michell obferves, that the perceptions can hardly be fuppofed to be fo acute, when the nerves, which are the chief inftruments of fenfation, do not receive the impreffions immediately, but only after they have been communicated to another fubftance. Befides, it muft be more natural to fuppofe, that, when the principal impreffion is made upon the choroides, it is communicated to the brain by its own proper nerves, which are abundantly fufficient for the purpofe.

151 Dimenfions of the fpot in the eye where there is no vifion.

The dimenfions and precife form of the fpot in the eye in which there is no vifion, were more accurately calculated by Daniel Bernouilli, in the following manner. He placed a piece of money O (fig. 3.) upon the floor; and then fhutting one of his eyes, and making a pendulum to fwing, fo that the extremity of it might be nearly in the line AO, he obferved at what place C it began to be invifible, and where it again emerged into view at A. Raifing the pendulum higher and lower, he found other points, as H, N, P, G, B, at which it began to be invifible; and others, as M, L, E, A, at which it began to be vifible again; and drawing a curve through them, he found that it was elliptical; and, with refpect to his own eye, the dimenfions of it were as follow; OC was 23, AC 10, BD 3, DH 13, and EG 14; fo that the centre being at F, the greater axis was to the lefs as 8 to 7.

Plate CCCLVIII

From thefe *data* the plane on which the figure was drawn being obliquely fituated with refpect to the eye, he found, that the place in the eye that correfponded to it was a circle, the diameter of which was a feventh part of the diameter of the eye, the centre of it being 27 parts of the diameter from the point oppofite to the pupil, a little above the middle. He concludes with obferving, that, in order that this fpace in which there is no vifion may be as fmall as poffible, it is neceffary that the nerve fhould enter the eye perpendicularly, and that both this end, and alfo its entering the eye at a diftance from its axis, are gained by the particular manner in which the two optic nerves unite and become feparate again, by croffing one another.

In favour of one of the obfervations of Mr Michell, concerning the ufe of the choroides in vifion, Dr Prieftley obferves, that Aquapendente mentions the cafe of a perfon at Pifa, who could fee very well in the night, but very little or none at all in the day time. This is alfo faid to be the cafe with thofe white people among the blacks of Africa, and the inhabitants of the ifthmus of America, who, from this circumftance, are called *moon-eyed*, Our author thinks it probable that their choroides is not of a dark colour, as it is in others of the human fpecies; but white or light-coloured, as in thofe animals which have moft occafion for their eyes in the night. See ALBINOS.

The following confiderations in favour of the retina being the proper feat of vifion, are worthy of remark.

152 Arguments for the retina's being the feat of vifion.

Dr Porterfield obferves, that the reafon why there is no vifion at the entrance of the optic nerve into the eye, may be, that it wants that foftnefs and delicacy which it has when it is expanded upon the choroides; and that, in thofe animals in which that nerve is inferted in the axis of the eye, it is obferved to be equally delicate, and therefore probably equally fenfible, in that place as in any other part of the retina. In general, the nerves, when conftringed by their coats, have but little fenfibility in comparifon of what they are endued with when they are divefted of them, and unfolded in a foft and pulpy fubftance.

Haller obferves, that the choroides cannot be the univerfal inftrument of vifion, becaufe that fometimes in men and birds, but efpecially in fifhes, it is covered internally with a black mucus, through which the rays cannot penetrate. This writer fpeaks of a fibrous membrane in the retina diftinct from its pulpy fubftance. On thefe fibres, he conjectures, that the images of objects are painted.

M. De la Hire's argument in favour of the retina, from the analogy of the fenfes, is much ftrengthened by confidering that the retina is a large nervous apparatus, immediately expofed to the impreffion of light; whereas the choroides receives but a flender fupply of nerves, in common with the fclerotica, the conjunctiva, and the eyelids, and that its nerves are much lefs expofed to the light than the naked fibres of the optic nerve. Indeed, from anatomical confiderations, one might imagine that any other part of the body was as fenfible of the impreffion of light as the choroides.

That the optic nerve is of principal ufe in vifion, is farther probable from feveral phenomena attending fome of the difeafes in which the fight is affected. When an amaurofis has affected one eye only, the optic nerve of that eye has been found manifeftly altered from its found ftate. Dr Prieftley was prefent when Mr Hey examined the brain of a young girl, who had been blind of one eye, and faw that the optic nerve belonging to it was confiderably fmaller than the other; and he informed him, that upon cutting into it, he found it to be much harder, and cineritious. Morgagni, indeed, mentions two cafes, in one of which he found the optic nerves fmaller than ufual, and of a cineritious colour, when, upon inquiry, he was informed that the perfon had not been blind, though there might have been fome defect in the fight of one of the eyes. In the other cafe, only one of the optic nerves was affected in that manner, and the eye itfelf was in other refpects very perfect. Here, alfo, he was exprefsly told, that the perfon was not blind of that eye; but it appears that he himfelf had not been acquainted with the perfons whom he diffected; and there have been many cafes of perfons being blind of one eye, without knowing it themfelves, for a a confiderable time.

Moreover, as the optic nerve is folely fpent in forming the retina, fo no function of the eye not immediately fubfervient to vifion, is affected by an amaurofis. On the contrary, thofe nerves which go to the choroides are found to retain, in this difeafe, their natural influence. The iris will contract in a recent gutta ferena of one eye, if the other remains found, and is fuddenly expofed to a ftrong light. The fclerotis, conjunctiva, and eyelids, which receive their nerves from the fame branches as the choroides, retain their fenfibility in this diforder.

The manner in which perfons recover from an amaurofis, favours the fuppofition of the feat of vifion being in the retina: fince thofe parts which are the moft diftant from the infertion of the nerve recover their fenfibility the fooneft, being in thofe places the

moft

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most pulpy and softest; whereas there is no reason to think that there is any difference in this respect in the different parts of the choroides. Mr Hey has been repeatedly informed, by persons labouring under an imperfect amaurosis, or gutta serena, that they could not, when looking at any object with one eye, see it so distinctly when it was placed directly opposite to the pupil, as when it was situated somewhat obliquely. And those persons whom he had known to recover from a perfect amaurosis, first discovered the objects whose images fell upon that part of the retina which is at the greatest distance from the optic nerve.

We shall conclude these remarks with observing, that if the retina be as transparent as it is generally represented to be, so that the termination of the pencils must necessarily be either upon the choroides, or some other opaque substance interposed between it and the retina, the action and reaction occasioned by the rays of light being at the common surface of this body and the retina, both these mediums (supposing them to be equally sensible to the impression of light) may be equally affected; but the retina, being naturally much more sensible to this kind of impression, may be the only instrument by which the sensation is conveyed to the brain, though the choroides, or the black substance with which it is sometimes lined, may also be absolutely necessary for the purpose of vision. Indeed when the reflection of the light is made at the common boundary of any two mediums, it is with no propriety that this effect is ascribed to one of them rather than the other; and the strongest reflections are often made back into the densest mediums, when they have been contiguous to the rarest, or even to a vacuum. This is not far from the hypothesis of M. de la Hire, and will completely account for the entire defect of vision at the insertion of the optic nerve.

153 Of bright and obscure vision.

Vision is distinguished into *bright* and *obscure*, *distinct* and *confused*.—It is said to be *bright*, when a sufficient number of rays enter the pupil at the same time; *obscure*, when too few. It is *distinct* when each pencil of rays is collected into a focus exactly upon the retina; *confused*, when they meet before they come at it, or when they would pass it before they meet; for, in either of these last cases, the rays flowing from different parts of the object will fall upon the same part of the retina, which must necessarily render the image confused and indistinct.—Now, that objects may appear with a due brightness, whether more or fewer rays proceed from them, we have a power of contracting or dilating the pupil, by means of the muscular fibres of the iris, in order to take in more or fewer rays as occasion requires. But this power has its limits. In some animals it is much greater than in others; particularly in such as are obliged to seek their food by night as well as by day, as in cats, &c.

154 Of distinct vision at different distances.

That the rays may be collected into points exactly upon the retina, that is, that objects may appear *distinct*, whether they be nearer or farther off, *i, e.* whether the rays proceeding from them diverge more or less, we have a power of contracting or relaxing the *ligamenta ciliaria*, and thereby altering the form of the crystalline humour, and with it the focal distance of the rays. Thus when the object we view is far off, and the rays fall upon the pupil with a very small degree of divergency, we contract the *ligamenta ciliaria*, which, being concave towards the vitreous humour, do thereby compress it more than otherwise they would do: by this means it is made to press harder upon the backside of the crystalline humour, which is thereby rendered flatter; and thus the rays proceed farther before they meet in a focus, than otherwise they would have done. Add to this, that we dilate the pupils of our eyes (unless in cases where the light is so strong that it offends the eye), and thereby admit rays into them that are more diverging than those which would otherwise enter. And, when the rays come from an object that is very near, and therefore diverge too much to be collected into their respective foci upon the retina, by relaxing the *ligamenta ciliaria*, we give the crystalline a more convex form, by which means the rays are made to suffer a proportionably greater degree of refraction in passing through it. Some philosophers are of opinion that we do this by a power of altering the form of the eye; and others, by removing the crystalline forwards or backwards as occasion requires: But neither of these opinions is probable; for the coats of the eye are too hard, in some animals, for the first; and, as to moving the crystalline out of its place, the cavities of the eye seem to be too well filled with the other humours to admit of such removal.

Besides this, in the case above-mentioned, by contracting the pupils of our eyes, we exclude the more diverging rays, and admit only such as are more easily refracted into their respective foci (G). But vision is not distinct at all distances, for our power of contracting and relaxing the *ligamenta ciliaria* is also circumscribed within certain limits.

155 Of short-sighted and long-sighted people.

In those eyes where the tunica cornea is very protuberant and convex, the rays of light suffer a very considerable refraction at their entrance into the aqueous humour, and are therefore collected into a focus before they fall upon the retina, unless the object be placed very near, so that the rays which enter the eye may have a considerable degree of divergency. People that have such eyes are said to be *purblind*. Now, the nearer an object is to the eye, the greater is the image of it therein, as explained above: these people, therefore can see much smaller objects than others, as seeing much nearer ones with the same distinctness; and their sight continues good longer than that of other people, because the tunica cornea of their eyes, as they grow old, becomes plainer, for want of that redundancy of humours with which they were filled before. On the contrary, old men having the cornea of their eyes too flat for want of a sufficient quantity of the aqueous humour to fill them out, if the rays diverge too



(G) Accordingly it is observed, that if we make a small hole with the point of a needle through a piece of paper, and apply that hole close to the eye, making use of it, as it were, instead of a pupil, we shall be able to see an object distinctly through it, though the object be placed within half an inch of the eye

Of Vision. too much before they enter the eye, they cannot be brought to a focus before they reach the retina: on which account those people cannot see distinctly, unless the object be situated at a greater distance from the eye than is required for those whose eyes are of a due form. The latter require the assistance of convex glasses to make them see objects distinctly; the former of concave ones. For if either the cornea *a b c*

Plate CCCLVIII. (fig. 4.), or crystalline humour *e*, or both of them, be too flat, as in the eye A, their focus will not be on the retina as at A, where it ought to be, in order to render vision distinct; but beyond the eye, as at *f*. This is remedied by placing a convex glass *g h* before the eye, which makes the rays converge sooner, and imprints the image duly on the retina at *d*. Again, If either the cornea, or crystalline humour, or both of them, be too convex, as in the eye B, the rays that enter it from the object C will be converged to a focus in the vitreous humour, as at *f*; and by diverging from thence to the retina, will form a very confused image thereon; and so of course, the observer will have as confused a view of the object as if his eye had been too flat. This inconvenience is remedied by placing a concave glass *g h* before the eye; which glass, by causing the rays to diverge between it and the eye, lengthens the focal distance so, that if the glass be properly chosen, the rays will unite at the retina, and form a distinct image of the object upon it.

156 Of the least angle of vision.

Such eyes as are of a due convexity, cannot see any object distinctly at less distance than six inches; and there are numberless objects too small to be seen at that distance, because they cannot appear under any sensible angle.—Concerning the least angle under which any object is visible, there was a debate between Dr Hooke and Hevelius. The former asserted that no object could well be seen if it subtended an angle less than one minute; and, if the object be round as a black circular spot upon a white ground, or a white circle upon a black ground, it follows, from an experiment made by Dr Smith, that this is near the truth; and from thence he calculates, that the diameter of the picture of such least visible point upon the retina is the 8000th part of an inch; which he therefore calls a *sensible point of the retina*. On the other hand, Mr Courtivron concluded from his experiments, that the smallest angle of vision was 40 seconds. According to Dr Jurin, there are cases in which a much smaller angle than one minute can be discerned by the eye; and in order to throw light upon the subject, he observes, that in order to our perceiving the impression made by any object upon our senses, it must either be of a certain degree of force, or of a certain degree of magnitude. For this reason, a star, which appears only as a lucid point through a telescope subtending not so much as an angle of one second, is visible to the eye; though a white or black spot of 25 or 30 seconds, is not to be perceived. Al-

157 Lines can be seen under smaller angles than spots, and why.

so a line of the same breadth with the circular spot will be visible at such a distance as the spot is not to be perceived at; because the quantity of impression from the line is much greater than from the spot; and a longer line is visible at a greater distance than a shorter one of the same breadth. He found by experience, that a silver wire could be seen when it subtended an angle of three seconds and a half; and that a silk thread could be seen when it subtended an angle of two seconds and an half.

This greater visibility of a line than of a spot seems to arise only from the greater quantity of the impression; but without the limits of perfect vision, our author observes, that another cause concurs, whereby the difference of visibility between the spot and the line is rendered much more considerable. For the impression upon the retina made by the line is then not only much greater, but also much stronger, than that of the spot; because the faint image, or penumbra, of any one point of the line, when the hole is placed beyond the limits of distinct vision, will fall within the faint image of the next point, and thereby much increase the light that comes from it.

In some cases our author found the cause of indistinct vision to be the unsteadiness of the eye; as our being able to see a single black line upon a white ground, or a single white line upon a black ground, and not a white line between two black ones on a white ground. In viewing either of the former objects, if the eye be imperceptibly moved, all the effect will be, that the object will be painted upon a different part of the retina; but wherever it is painted, there will be but one picture, single and uncompounded with any other. But in viewing the other, if the eye fluctuate ever so little, the image of one or other of the black lines will be so shifted to that part of the retina which was before possessed by the white line; and this must occasion such a dazzle in the eye, that the white line cannot be distinctly perceived, and distinguished from the black lines; which, by a continual fluctuation, will alternately occupy the space of the white line, whence must arise an appearance of one broad dark line, without any manifest separation.

By trying this experiment with two pins of known diameters, set in a window against the sky light, with a space between them equal in breadth to one of the pins, he found that the distance between the pins could hardly be distinguished when it subtended an angle of less than 40 seconds, though one of the pins alone could be distinguished when it subtended a much less angle. But though a space between two pins cannot be distinguished by the eye when it subtends an angle less than 40 seconds, it would be a mistake to think that the eye must necessarily commit an error of 40 seconds in estimating the distance between two pins when they are much farther from one another. For if the space between them subtend an angle of one minute, and each of the pins subtend an angle of four seconds which is greater than the least angle the eye can distinguish, it is manifest that the eye may judge of the place of each pin within two seconds at the most; and consequently the error committed in taking the angle between them cannot at the most exceed four seconds, provided the instrument be sufficiently exact. And yet, says he, upon the like mistake was founded the principal objection of Dr Hooke against the accuracy of the celestial observations of Hevelius.

A black spot upon a white ground, or white spot upon a black ground, he says can hardly be perceived by the generality of eyes when it subtends a less angle than one minute. And if two black spots be made upon

Of Vision. upon white paper, with a ſpace between them equal in breadth to one of their diameters, that ſpace is not to be diſtinguiſhed, even within the limits of perfect viſion, under ſo ſmall an angle as a ſingle ſpot of the ſame ſize can be diſtinguiſhed. To ſee the two ſpots diſtinctly, therefore, the breadth of the ſpace between them muſt ſubtend an angle of more than a minute. It would be very difficult, he ſays, to make this experiment accurately, within the limits of perfect viſion; becauſe the objects muſt be extremely ſmall: but by a rude trial, made with ſquare bits of white paper, placed upon a black ground, he judged, that the leaſt angle under which the interval of two objects could be perceived, was at leaſt a fourth part greater than the leaſt angle under which a ſingle object can be perceived. So that an eye which cannot perceive a ſingle object under a ſmaller angle than one minute, will not perceive the interval between two ſuch objects under a leſs angle than 75 ſeconds.

Without the limits of perfect viſion, the diſtance at which a ſingle object ceaſes to be perceivable will be much greater in proportion than the diſtance at which a ſpace of equal breadth between two ſuch objects ceaſes to be perceivable. For, without theſe limits, the image of each of the objects will be attended with a penumbra, and the penumbra of the two near objects will take up part of the ſpace between them, and thereby render it leſs perceivable; but the penumbra will add to the breadth of the ſingle object, and will thereby make it more perceivable, unleſs its image be very faint. Upon the ſame principles he likewiſe accounts for the radiation of the ſtars, whereby the light ſeems to project from them different ways at the ſame time.

Mr Mayer made many experiments in order to aſcertain the ſmalleſt angle of viſion in a variety of reſpects. He began with obſerving at what diſtance a black ſpot was viſible on white paper; and found, that when it could barely be diſtinguiſhed, it ſubtended an angle of about 34 ſeconds. When black lines were diſpoſed with intervals broader than themſelves, they were diſtinguiſhed at a greater diſtance than they could be when the objects and the intervals were of an equal breadth. In all theſe caſes it made no difference whether the objects were placed in the ſhade or in the ſtrong light of the ſun; but when the degrees of light were ſmall, their differences had a conſiderable effect, though by no means in proportion to the differences of the light. For if an object was illuminated to ſuch a degree as to be juſt viſible at the diſtance of nine feet, it would be viſible at the diſtance of four feet, though the light was diminiſhed above 160 times. It appeared in the courſe of theſe experiments, that common day light is, at a medium, equal to that of 25 candles placed at the diſtance of one foot from the object.

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Of ſingle viſion with two eyes.

As an image of every viſible object is painted on the retina of each of our eyes, it thence becomes a natural queſtion, Why we do not ſee every thing double? It was the opinion of Sir Iſaac Newton and others, that objects appear ſingle becauſe the two optic nerves unite before they reach the brain. But Dr Porterfield ſhows, from the obſervation of ſeveral anatomiſts, that the optic nerves do not mix, or confound their ſubſtance, being only united by a cloſe coheſion; and objects have appeared ſingle where the optic nerves were diſjoined. Of Viſion.

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Solutions of this difficulty by Dr Briggs.

Dr Briggs ſuppoſed that ſingle viſion was owing to the equal tenſion of the correſponding parts of the optic nerves, whereby they vibrated in a ſynchronous manner. But, beſides ſeveral improbable circumſtances in this account, Dr Porterfield ſhows that facts do by no means favour it.

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Dr Porterfield.

To account for this phenomenon, this ingenious writer ſuppoſes, that by an original law in our natures, we imagine objects to be ſituated ſomewhere in a right line drawn from the picture of it upon the retina, through the centre of the pupil. Conſequently, the ſame object appearing to both eyes to be in the ſame place, the mind cannot diſtinguiſh it into two. In anſwer to an objection to this hypotheſis, from objects appearing double when one eye is diſtorted, he ſays the mind miſtakes the poſition of the eye, imagining that it had moved in a manner correſponding to the other, in which caſe the concluſion would have been juſt. In this he ſeems to have recourſe to the power of habit, though in words he diſclaims that hypotheſis.

This principle, however, has generally been thought to be ſufficient to account for this appearance. Originally, every object making two pictures, one in each eye, is imagined to be double; but by degrees, we find, that when two correſponding parts of the retina are impreſſed, the object is but one; but if thoſe correſponding parts be changed, by the diſtortion of one of the eyes, the object muſt again appear double as at the firſt. This ſeems to be verified by Mr Cheſelden; who informs us, that a gentleman, who from a blow on his head had one eye diſtorted, found every object to appear double; but by degrees the moſt familiar ones came to appear ſingle again, and in time all objects did ſo, without any amendment of the diſtortion. A caſe ſimilar to this is mentioned by Dr Smith.

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Dr Reid, and

On the other hand, Dr Reid is of opinion, that the correſpondence of the centres of the two eyes, on which ſingle viſion depends, does not ariſe from cuſtom, but from ſome natural conſtitution of the eye and of the mind. He makes ſeveral juſt objections to the caſe of Mr Foſter, recited by Dr Smith and others; and thinks that the caſe of the young man couched by Cheſelden, who ſaw ſingly with both eyes immediately upon receiving his ſight, is nearly deciſive in proof of his ſuppoſition. He alſo found that three young gentlemen, whom he endeavoured to cure of ſquinting, ſaw objects ſingly, as ſoon as ever they were brought to direct the centres of both their eyes to the ſame object, though they had never been uſed to do ſo from their infancy; and he obſerves, that there are caſes, in which, notwithſtanding the fulleſt conviction of an object being ſingle, no practice of looking at it will ever make it appear ſo, as when it is ſeen through a multiplying glaſs.

To all theſe ſolutions of the difficulty reſpecting ſingle viſion by both eyes, objections have been lately made which ſeem inſurmountable. By experiments judiciouſly conceived and accurately conducted, Dr Wells has ſhown, that it is neither by cuſtom alone, nor by the original property of the eyes alone, that objects appear ſingle; and having demoliſhed the theories

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162 Dr Wells. "The visible place of an object being composed of its visible distance and visible direction, to show how it may appear the same to both eyes, it will be necessary (says he *) to explain in what manner the distance and direction, which are perceived by one eye, may coincide with those which are perceived by the other." With respect to visible distance, the author's opinion seems not to differ from that which we have stated elsewhere (see METAPHYSICS, N° 49, 50); and therefore we have to attend only to what he says of visible direction.

* *Essay on single Vision, &c.*

When a small object is so placed with respect to either eye, as to be seen more distinctly than in any other situation, our author says that it is then in the *optic axis*, or the axis of that eye. When the two optic axes are directed to a small object not very distant, they may be conceived to form two sides of a triangle, of which the base is the interval between the points of the corners where the axes enter the eyes. This base he called the *visual base;* and a line drawn from the middle of it to the point of intersection of the optic axis he calls the *common aixs*. He then proceeds to show, that objects *really situated* in the *optic* axis do not *appear* to be in that line, but in the *common axis*.

"Every person (says he) knows, that if an object be viewed through two small holes, one applied to each eye, the two holes appear but as one. The theories thitherto invented afford two explanations of this fact. According to Aguilonius, Dechales, Dr Porterfield, and Dr Smith, the two holes, or rather their borders, will be seen in the same place as the object viewed through them, and will consequently appear united, for the same reason that the object itself is seen single. But whoever makes the experiment will distinctly perceive, that the united hole is much nearer to him than the object; not to mention, that any fallacy on this head might be corrected by the information from the sense of touch, that the card or other substance in which the holes have been made is within an inch or less of our face. The other explanation is that furnished by the theory of Dr Reid. According to it, the centres of the retinas, which in this experiment receive the pictures of the holes, will, by an original property, represent but one. This theory, however, though it makes the two holes to appear one, does not determine where this one is to be seen. It cannot be seen in only one of the perpendiculars to the images upon the retinas, for no reason can be given why this law, of visible direction, which Dr Reid thinks established beyond dispute, if it operates at all, should not operate upon both eyes at the same time; and if it be seen by both eyes in such lines, it must appear where those lines cross each other, that is, in the same place with the object viewed through the holes, which, as I have already mentioned, is contrary to experience. Nor is it seen in any direction, the consequence of a law affecting both eyes considered as one organ, but suspended when each eye is used separately. For when the two holes appear one, if we pay attention to its situation, and then close one eye, the truly single hole will be seen by the eye remaining open in exactly the same direction as the apparently single hole was by both eyes.

"Hitherto I have supposed the holes almost touching the face. But they have the same unity of appearance, in whatever parts of the optic axes they are placed; whether both be at the same distance from the eyes, or one be close to the eye in the axis of which it is, and the other almost contiguous to the object seen through them. If a line, therefore, be drawn from the object to one of the eyes, it will represent all the real or tangible positions of the hole, which allow the object to be seen by that eye, and the whole of it will coincide with the optic axis. Let a similar line be drawn to the other eye, and the two must appear but as one line; for if they do not, the two holes in the optic axes will not, at every distance, appear one, whereas experiments prove that they do. This united line will therefore represent the visible direction of every object situated in either of the optic axes. But the end of it, which is toward the face, is seen by the right eye to the left, and by the left eye as much to the right. It must be seen then in the middle between the two, and consequently in the common axis. And as its other extremity coincides with the point where the optic axes intersect each other, the whole of it must lie in the common axis. Hence the truth of the proposition is evident, that objects situated in the optic axis, do not appear to be in that line, but in the common axis."

He then proves by experiments, for which we must refer to his work, that objects situated in the common axis do not *appear* to be in that line, but in the axis of the eye by which they are not seen: that is, an object situated in the common axis appears to the right eye in the axis of the left, and *vice versa*. His next proposition, proved likewise by experiments, is, that "objects, situated in any line drawn through the mutual intersection of the optic axes to the visual base, do not appear to be in that line, but in another, drawn through the same intersection, to a point in the visual base distant half this base from the similar extremity of the former line towards the left, if the objects be seen by the right eye, but towards the right if seen by the left eye."

From these propositions he thus satisfactorily accounts for single vision by both eyes. "If the question be concerning an object at the concourse of the optic axes, it is seen single, because its two similar appearances, in regard to size, shape, and colour, are seen by both eyes in one and the same direction, or if you will, in two directions, which coincide with each other through the whole of their extent. It therefore matters not whether the distance be truly or falsely estimated; whether the object be thought to touch our eyes, or to be infinitely remote. And hence we have a reason, which no other theory of visible direction affords, why objects appeared single to the young gentleman mentioned by Mr Chefelden, immediately after his being couched, and before he could have learned to judge of distance by sight.

"When two similar objects are placed in the optic axes, one in each, at equal distances from the eyes, they will appear in the same place, and therefore one, for the same reason that a truly single object, in the concourse of the optic axes, is seen single.

"To finish this part of my subject, it seems only necessary to determine, whether the dependence of visible direction upon the actions of the muscles of the eyes

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eyes be estalished by nature, or by custom. But facts are here wanting. As far as they go, however, they serve to prove that it arises from an original principle of our constitution. For Mr Cheselden's patient saw objects single, and consequently in the same directions with both eyes, immediately after he was couched; and persons affected with squinting from their earliest infancy see objects in the same directions with the eye they have never been accustomed to employ, as they do with the other they have constantly used."

The author removes many difficulties, and obviates the objections to which his theory may seem most liable. The whole work deserves to be attentively studied by every optician; and we therefore recommend it to the perusal of our readers.

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Objects seen with both eyes appear brighter than when seen with only one.

We are indebted to Dr Jurin for the following curious experiments, to determine whether an object seen by both eyes appears brighter than when seen with one only.

He laid a slip of clean white paper directly before him on a table, and applying the side of a book close to his right temple, so as that the book was advanced considerably more forward than his face, he held it in such a manner, as to hide from his right eye that half of the paper which lay to his left hand, while the left half of the paper was seen by both eyes, without any impediment.

Then looking at the paper with both eyes, he observed it to be divided, from the top to the bottom, by a dark line, and the part which was seen with one eye only was manifestly darker than that which was seen with both eyes; and, applying the book to his left temple, he found, by the result of the experiment, that both his eyes were of equal goodness.

He then endeavoured to find to what degree this excess of brightness amounted; and comparing it with the appearance of an object illuminated partly by one candle and partly by two, he was surprised to find that an object seen with two eyes is by no means twice as luminous as when it is seen with one only; and after a number of trials, by which he made the proportion less and less continually, he found, that when one paper was illuminated by a candle placed at the distance of three feet, and another paper by the same candle at the same distance, and by another candle at the distance of 11 feet, the former seen by both eyes, and the latter with one eye only, appeared to be of equal whiteness; so that an object seen with both eyes appears brighter than when it is seen with one only by about a 13th part. But he acknowledges, that it is difficult to make this experiment exactly.

He then proceeded to inquire, whether an object seen with both eyes appears any thing larger than when seen with one only; but he concluded that it did not, except on account of some particular circumstances, as in the case of the binocular telescope and the concave speculum.

M. du Tour maintains, that the mind attends to no more than the image made in one eye at a time; and produces several curious experiments in favour of this hypothesis, which had also been maintained by Kepler and almost all the first opticians. But, as M. Buffon observes, it is a sufficient answer to this hypothesis, how ingeniously soever it may be supported, that we see more distinctly with two eyes than with one; and that when a round object is near us, we plainly see more of the surface in one case than in the other. There are also other facts which clearly prove the contrary of what is maintained by M. du Tour.

With respect to single vision with two eyes, Dr Hartley observes, that it deserves particular attention, that the optic nerves of men, and such other animals as look the same way with both eyes, unite in the *cella turcica* in a ganglion, or little brain, as one may call it, peculiar to themselves; and that the associations between synchronous impressions on the two retinas must be made sooner and cemented stronger on this account: also that they ought to have a much greater power over one another's images, than in any other part of the body. And thus an impression made on the right eye alone, by a single object, may propagate itself into the left, and there raise up an image almost equal in vividness to itself; and consequently when we see with one eye only, we may, however, have pictures in both eyes.

A curious deception in vision, arising from the use of both eyes, was observed and accounted for by Dr Smith. It is a common observation, he says, that objects seen with both eyes appear more vivid and stronger than they do to a single eye; especially when both of them are equally good. A person not short sighted may soon be convinced of this fact, by looking attentively at objects that are pretty remote, first with one eye, and then with both. This observation gave occasion to the construction of the binocular telescope, in the use of which the phenomenon is still more striking.

Besides this, our author observes, that there is another phenomenon observable with this instrument, which is very remarkable. In the foci of the two telescopes there are two equal rings, as usual, which terminate the pictures of the objects there formed, and consequently the visible area of the objects themselves. These equal rings, by reason of the equal eye-glasses, appear equal, and equally distant when seen separately by each eye; but when they are seen with both eyes, they appear much larger, and more distant also; and the objects seen through them do also appear much larger, though circumscribed by their united rings, in the same places as when they were seen separately.

He observes that the phenomenon of the enlarged circle of the visible area in the binocular telescope, may be seen very plainly in looking at distant objects through a pair of spectacles, removed from the eyes about four or five inches, and held steady at that distance. The two innermost of the four apparent rings, which hold the glasses, will then appear united in one larger and more distant ring than the two outermost, which will hardly be visible unless the spectacles be farther removed.

A curious circumstance relating to the effect of one eye upon the other, was noticed by M. Æpinus, who observed, that, when he was looking through a hole made in a plate of metal, about the 10th part of a line in diameter, with his left eye, both the hole itself appeared larger, and also the field of view seen through it was more extended, whenever he shut his right eye; and both these effects were more remarkable when that eye was covered with his hand. He found considerable difficulty in measuring this augmentation of the apparent

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apparent diameter of the hole, and of the field of view; but at length he found, that, when the hole was half an inch, and the tablet which he viewed through it was three feet from his eye, if the diameter of the field when both his eyes were open was 1, it became 1¼ when the other eye was shut, and nearly 2 when his hand was laid upon it.

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When one eye is closed, the pupil of the other is enlarged.

Upon examining this pheonomenon, it presently appeared to depend upon the enlargement of the pupil of one eye when the other is closed, the physical or anatomical cause of which he did not pretend to assign; but he observes, that it is wisely appointed by divine Providence, in order that when one eye fails, the field of view in the other may be extended. That this effect should be more sensible when the eye is covered with the hand, is owing, he observes, to the eyelids not being impervious to the light. But the enlargement of the pupil does not enlarge the field of view, except in looking through a hole, as in this particular case; and therefore persons who are blind of one eye can derive no advantage from this circumstance. Before we applaud the wisdom of Providence in any part of the constitution of nature, we should be very sure that we do not mistake concerning the effects of that constitution.

A great deal has been written by Gassendi, Le Clerc, Musschenbroek, and Du Tour, concerning the place to which we refer an object viewed by one or both eyes. But the most satisfactory account of this matter that we have met with, the reader will find in Dr Well's Essay above quoted, which will teach any person how to satisfy himself by experiment with respect to visible position and visible motion.

## § 4. *Of the Appearance of Objects seen through Media of different Forms.*

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The various appearances of objects seen thro' media of different forms stated and investigated.

For the more easy apprehension of what relates to this subject, we shall premise the five following particulars, which either have been already mentioned, or follow from what has been before laid down.

1. That as each point of an object, when viewed by the naked eye, appears in its proper place, and as that place is always to be found in the line in which the axis of a pencil of rays flowing from it enters the eye, or else in the line which Dr Wells calls the common axis; we from hence acquire a habit of judging the point to be situated in that line: and, because the mind is unacquainted with what refractions the rays suffer before they enter the eye, therefore, in cases where they are diverted from their natural course, by passing through any medium, it judges the point to be in that line produced back in which the axis of a pencil of rays flowing from it is situated the instant they enter the eye, and not in that it was in before refraction. We shall therefore, in what follows, suppose the apparent place of an object, when seen through a refracting medium, to be somewhere in that line produced back in which the axis of a pencil of rays flowing from it proceeds after they have passed through the medium.

2. That we are able to judge, though imperfectly, of the distance of an object by the degree of divergency, wherein the rays flowing from the same point of the object enter the pupil of the eye, in cases where that divergency is considerable; but because in what follows it will be necessary to suppose an object, when seen through a medium whereby its apparent distance is altered, to appear in some determinate situation, in those cases where the divergency of the rays at their entrance into the eye is considerable, we will suppose the object to appear where those lines which they describe in entering, if produced back, would cross each other: though it must not be asserted, that this is the precise distance; because the brightness, distinctness, and apparent magnitude of the object, on which its apparent distance in some measure depends, will also suffer an alteration by the refraction of the rays in passing through that medium.

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3. That we estimate the magnitude of an object by that of the optic angle.

4. That vision is the brighter, the greater the number of rays is which enter the pupil. And,

5. That, in some cases, the apparent brightness, distinctness, and magnitude of an object, are the only means whereby our judgment is determined in estimating the distance of it.

Prop. I. An object placed within a medium terminated by a plane surface on that side which is next the eye, if the medium be denser than that in which the eye is (as we shall always suppose it to be, unless where the contrary is expressed), appears nearer to the surface of the medium than it is.

Plate CCCLVIII.

Thus, if A be a point of an object placed within the medium BDCE (fig. 5.), and A*b* A*c* be two rays proceeding from thence, these rays passing out of a denser into a rarer medium, will be refracted from their respective perpendiculars *bd*, *ce*, and will enter the eye at H, suppose in the directions *bf*, *cg*: let then these lines be produced back till they meet in F; this will be the apparent place of the point A: and because the refracted rays *bf*, *cg* will diverge more than the incident ones A*b*, A*c*, it will be nearer to the points *b* and *c* than the point A; and as the same is true of each point in the object, the whole will appear to an eye at H, nearer to the surface BC than it is.

From hence it is, that when one end of a straight stick is put under water, and the stick is held in an oblique position, it appears bent at the surface of the water; viz. because each point that is under water appears nearer the surface, and consequently higher than it is.

From hence likewise it is, that an object at the bottom of a vessel may be seen when the vessel is filled with water, though it be so placed with respect to the eye, that it cannot be seen when the vessel is empty. To explain this, let ABCD (fig. 6.) represent a vessel, and let E be an object lying at the bottom of it. This object, when the vessel is empty, will not be seen by an eye at F, because HB, the upper part of the vessel, will obstruct the ray EH; but when it is filled with water to the height GI, the ray at EK being refracted at the surface of the water into the line KF, the eye at F shall see the object by means of that.

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An object situated in the horizon appears above its true place.

In like manner, an object situated in the horizon appears above its true place, upon account of the refraction of the rays which proceed from it in their passage through the atmosphere of the earth. For, first, If the object be situated beyond the limits of the atmosphere, its rays in entering it will be refracted towards the

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the perpendicular; that is, towards a line drawn from the point where they enter, to the centre of the earth, which is the centre of the atmosphere: and as they pass on, they will be continually refracted the same way, because they are all along entering a denser part, the centre of whose convexity is still the same point; upon which account the line they describe will be a curve bending downwards: and therefore none of the rays that come from that object can enter an eye upon the surface of the earth, except what enter the atmosphere higher than they need to do if they could come in a right line from the object: consequently the object must appear above its proper place. Secondly, If the object be placed within the atmosphere, the case is still the same; for the rays which flow from it must continually enter a denser medium whose centre is below the eye; and therefore being refracted towards the centre, that is, downwards as before, those which enter the eye must necessarily proceed as from some point above the object; wherefore the object will appear above its proper place.

From hence it is, that the sun, moon, and stars, appear above the horizon, when they are just below it; and higher than they ought to do, when they are above it: Likewise distant hills, trees, &c. seem to be higher than they are.

Further, The lower these objects are in the horizon, the greater is the obliquity with which the rays which flow from them enter the atmosphere, or pass from the rarer into the denser parts of it; and therefore they appear to be the more elevated by refraction: upon which account the lower parts of them are apparently more elevated than the other. This makes their upper and under parts seem nearer than they are; as is evident from the sun and moon, which appear of an oval form when they are in the horizon, their horizontal diameters appearing of the same length they would do if the rays suffered no refraction, while their vertical ones are shortened thereby.

Prop. II. An object seen through a medium terminated by plane and parallel surfaces, appears nearer, brighter, and larger, than with the naked eye.

Plate CCLVIII.

167 An object seen thro' a plane medium appears nearer and brighter than seen by the naked eye.

For instance, let AB (fig. 7.) be the object, CDEF the medium, and GH the pupil of an eye, which is here drawn large to prevent confusion in the figure.— And, 1st, let RK, RL, be two rays proceeding from the point R, and entering the denser medium at K and L; these rays will here by refraction be made to diverge less, and to proceed afterwards, suppose in the lines K*a*, L*b*; at *a* and *b*, where they pass out of the denser medium, they will be as much refracted the contrary way, proceeding in the lines *ac*, *bd*, parallel to their first directions. Produce these lines back till they meet in *e*; this will be the apparent place of the point R; and it is evident from the figure, that it must be nearer the eye than that point; and because the same is true of all other pencils flowing from the object AB, the whole will be seen in the situation *fg*, nearer to the eye than the line AB. 2d, As the rays RK, RL, would not have entered the eye, but have passed by it in the directions K*r*, L*t*, had they not been refracted in passing through the medium, the object appears brighter. 3d, The rays A*h*, B*i*, will be refracted at *h* and *i* into the less converging lines *hk*, *il*, and at the other surface into *k*M, *l*M, parallel to A*h* and B*i* produced; so that the extremities of the object will appear in the lines M*k*, M*l* produced, viz. in *f* and *g*, and under as large an angle *f*M*g*, as the angle A*q*B under which an eye at *q* would have seen it had there been no medium interposed to refract the rays; and therefore it appears larger to the eye at GH, being seen through the interposed medium, than otherwise it would have done. But it is here to be observed, that the nearer the point *e* appears to the eye on account of the refraction of the rays RK, RL, the shorter is the image *fg*, because it is terminated by the lines M*f* and M*g*, upon which account the object is made to appear less; and therefore the apparent magnitude of an object is not much augmented by being seen through a medium of this form.

Farther, It is apparent from the figure, that the effect of a medium of this form depends wholly upon its thickness; for the distance between the lines R*r* and *ec*, and consequently the distance between the points *e* and R, depends upon the length of the line K*a*:— Again, The distance between the lines AM and *f*M depends on the length of the line *hk*; but both K*a* and *kh* depend on the distance between the surfaces CE and DF, and therefore the effect of this medium depends upon its thickness.

Prop. III. An object seen through a convex lens, appears larger, brighter, and more distant, than with the naked eye.

168 Seen thro' a convex lens appears larger, brighter, and more distant.

To illustrate this, let AB (fig. 8.) be the object, CD the lens, and EF the eye. 1. From A and B, the extremities of the object, draw the lines AY*r*, BX*r*, crossing each other in the pupil of the eye; the angle A*r*B comprehended between these lines, is the angle under which the object would be seen with the naked eye. But by the interposition of a lens of this form, whose property it is to render converging rays more so, the rays AY and BX will be made to cross each other before they reach the pupil. There the eye at E will not perceive the extremities of the object by means of these rays (for they will pass it without entering), but by some others which must fall without the points Y and X, or between them; but if they fall between them, they will be made to concur sooner than they themselves would have done; and therefore, if the extremities of the object could not be seen by them, it will much less be seen by these. It remains therefore, that the rays which will enter the eye from the points A and B after refraction, must fall upon the lens without the points Y and X; let then the rays AO and BP be such. These after refraction entering the eye at *r*, the extremities of the object will be seen in the lines *r*Q, *r*T, produced, and under the optic angle Q*r*T, which is larger than A*r*B, and therefore the apparent magnitude of the object will be increased.— 2. Let GHI be a pencil of rays flowing from the point G; as it is the property of this lens to render diverging rays less diverging, parallel, or converging, it is evident that some of those rays, which would proceed on to F and E, and miss the eye were they to suffer no refraction in passing through the lens, will now enter it; by which means the object will appear brighter. 3. As to the apparent distance of the object, that will vary according to the situation of it with respect to the focus of parallel rays of the lens. 1. Then

Appearance of objects seen through Media of different Forms.

1. Then, let us suppose the object placed so much nearer the lens than its focus of parallel rays, that the refracted rays KE and LF, though rendered less diverging by passing through it, may yet have a considerable degree of divergency, so that we may be able to form a judgment of the distance of the object thereby. In this case, the object ought to appear where EK, FL, produced back concur; which, because they diverge less than the rays GH, GI, will be beyond G, that is, at a greater distance from the lens than the object is. But because both the brightness and magnitude of the object will at the same time be augmented, prejudice will not permit us to judge it quite so far off as the point where those lines meet, but somewhere between that point and its proper place. 2. Let the object be placed in the focus of parallel rays, then will the rays KE and LF become parallel; and though in this case the object would appear at an immense distance, if that distance were to be judged of by the direction of the rays KE and LF, yet upon account of the brightness and magnitude of it, we shall not think it much farther from us than if it were seen by the naked eye. 3. If the object be situated beyond the focus of parallel rays, as in BA (fig. 9.), the rays flowing from thence and falling upon the lens CD, will be collected into their respective foci at *a* and *b*, and the intermediate points *m*, *n*, &c. and will there form an image of the object AB; and after crossing each other in the several points of it, as expressed in the figure, will pass on diverging as from a real object. Now if an eye be situated at *c*, where A*c*, B*c*, rays proceeding from the extreme points of the object, make not a much larger angle A*c*B, than they would do if there were no lens interposed, and the rays belonging to the same pencil do not converge so much as those which the eye would receive if it were placed nearer to *a* or *b*, the object upon these accounts appearing very little larger or brighter than with the naked eye, is seen nearly in its proper place: but if the eye recedes a little way towards *ab*, the object then appearing both brighter and larger, seems to approach the lens: which is an evident proof of what has been so often asserted, *viz.* that we judge of the distance of an object in some measure by its brightness and magnitude; for the rays converge the more the farther the eye recedes from the lens; and therefore if we judged of the distance of the object by the direction of the rays which flow from it, we ought in this case to conceive it at a greater distance, than when the rays were parallel, or diverged at their entrance into the eye.

Plate CCCLVIII.

That the object should seem to approach the lens in this case, was a difficulty that exceedingly puzzled the learned Barrow, and which he pronounces insuperable, and not to be accounted for by any theory we have of vision. Molineaux also leaves it to the solution of others, as that which will be inexplicable, till a more intimate knowledge of the visive faculty, as he expresses it, be obtained by mortals.

They imagined, that seeing an object appears farther off, the less the rays diverge which fall upon the eye, if they should proceed parallel to each other, it ought to appear exceeding remote; and if they should converge, it should then appear more distant still: the reason of this was, because they looked upon the apparent place of an object, as owing only to the direction of the rays whatever it was, and not at all to its apparent magnitude or splendour.

Perhaps it may proceed from our judging of the distance of an object in some measure by its magnitude, that that deception of sight commonly observed by travellers may arise; *viz.* that upon the first appearance of a building larger than usual, as a cathedral church, or the like, it generally seems nearer to them, than they afterwards find it to be.

169 In certain circumstances an object seen through a convex lens appears inverted and pendulous in the air.

Prop. IV. If an object be placed farther from a convex lens than its focus of parallel rays, and the eye be situated farther from it on the other side than the place where the rays of the several pencils are collected into their respective foci, the object appears inverted, and pendulous in the air, between the eye and the lens.

To explain this, let AB (fig. 9.) represent the object, CD the lens; and let the rays of the pencil ACD be collected in *a*, and those of BCD in *b*, forming there an inverted image of the object AB, and let the eye be placed in F: it is apparent from the figure, that some of the refracted rays which pass through each point of the image will enter the eye as from a real object in that place; and therefore the object AB will appear there, as the proposition asserts. But we are so little accustomed to see objects in this manner, that it is very difficult to perceive the image with one eye; but if both eyes are situated in such a manner, that rays flowing from each point of the image may enter both, as at G and H, and we direct our optic axes to the image, it is easy to be perceived.

If the eye be situated in *a* or *b*, or very near them on either side, the object appears exceedingly confused, *viz.* if at *d*, the rays which proceed from the same point of the object converge so very much, and if at *e*, they diverge so much, that they cannot be collected together upon the retina, but fall upon it as if they were the axes of so many distinct pencils coming through every point of the lens; wherefore little more than one single point of the object is seen at a time, and that appears all over the lens; from whence nothing but confusion arises.

If the lens be so large that both eyes may be applied to it, as in *h* and *k*, the object will appear double; for it is evident from the figure, that the rays which enter the eye at *h* from either extremity of the object A or B, do not proceed as from the same point with that from whence those which enter the other at *k* seem to flow; the mind therefore is here deceived, and looks upon the object as situated in two different places, and therefore judges it to be double.

170 An object through a concave lens is seen nearer, smaller, and less bright than with the naked eye.

Prop. V. An object seen through a concave lens appears nearer, smaller, and less bright, than with the naked eye.

Thus, let AB (fig. 10.) be the object, CD the pupil of an eye, and EF the lens. Now, as it is the property of a lens of this form to render diverging rays more so, and converging ones less so, the diverging rays GH, GI, proceeding from the point G, will be made to diverge more, and so to enter the eye as from some nearer point *g*; and the rays AH, BI, which converge, will be made to converge less, and to enter the eye as from the points *a* and *b*; wherefore the objects will appear in the situation *a g b*, less and

Reflection of Light.

and nearer than without the lens. Further, As the rays which proceed from G are rendered more diverging, some of them will be made to pass by the pupil of the eye, which otherwise would have entered it, and therefore each point of the object will appear less bright.

Prop. VI. An object seen through a polygonous glass, that is, such as is terminated by several plain surfaces, is multiplied thereby.

Plate CCCLVIII. For instance, let A (fig. 11.) be an object, and BC a polygonous glass terminated by the plane surfaces BD, DE, &c. and let the situation of the eye F be such, that the rays AB being refracted in passing through the glass, may enter it in the direction BF, and the rays AC in the direction CF. Then will the eye, by means of the former, see the object in G, and by the latter in H; and by means of the rays AI, the object will appear also in its proper situation A.

## Sect. III. *Of the Reflection of Light.*

171 Some portion of light always reflected from transparent bodies.

When a ray of light falls upon any body, however transparent, the whole of it never passes through the body, but some part is always driven back or reflected from it; and it is by this reflected light that all bodies which have no light of their own become visible to us. Of that part of the ray which enters, another part is also reflected from the second surface, or that which is farthest from the luminous body. When this part arrives again at the first surface, part of it is reflected back from that surface; and thus it continues to be reflected between the two surfaces, and to pass backwards and forwards within the substance of the medium, till some part is totally extinguished and lost. Besides this inconsiderable quantity, however, which is lost in this manner, the second surface often reflects much more than the first; insomuch that, in certain positions, scarce any rays will pass through both sides of the medium. A very considerable quantity is also unaccountably lost or extinguished at each reflecting surface; insomuch that no body, however transparent, can transmit all the rays which fall upon it; neither, though it be ever so well fitted for reflection, will it reflect them all.

### § 1. *Of the Cause of Reflection.*

The reflection of light is by no means so easily accounted for as the refraction of the same fluid. This property, as we have seen in the last section, may be accounted for in a satisfactory manner by the supposition of an attractive power diffused throughout the medium, and extending a very little way beyond it; but with regard to the reflection of light, there seems to be no satisfactory hypothesis hitherto invented. Of the principal opinions on this subject Mr Rowning hath given us the following account.

172 Light is not reflected by impinging on the solid parts of bodies at the first surface,

I. It was the opinion of philosophers, before Sir Isaac Newton discovered the contrary, that light is reflected by impinging upon the solid parts of bodies. But that it is not so, is clear for the following reasons.

And, first, It is not reflected at the first surface of a body by impinging against it.

For it is evident, that, in order to the due and regular reflection of light, that is, that the reflected rays should not be dispersed and scattered one from another, there ought to be no rasures or unevenness in the reflecting surface large enough to bear a sensible proportion to the magnitude of a ray of light; because if the surface abounds with such, the reflected rays will rather be scattered like a parcel of pebbles thrown upon a rough pavement, than reflected with that regularity with which light is observed to be from a well polished surface. Now those surfaces, which to our senses appear perfectly smooth and well polished, are far from being so; for to polish, is no other than to grind off the larger eminences and protuberances of the metal with the rough and sharp particles of sand, emery, or putty, which must of necessity leave behind them an infinity of rasures and scratches, which, though inconsiderable with regard to the former roughnesses, and too minute to be discerned by us, must nevertheless bear a large proportion to, if not vastly exceed, the magnitude of the particles of light.

173 nor at the second.

Secondly, It is not reflected at the second surface by impinging against any solid particles.

That it is not reflected by impinging upon the solid particles which constitute this second surface, is sufficiently clear from the foregoing argument; the second surfaces of bodies being as incapable of a perfect polish as the first: and it is farther confirmed from hence, viz. that the quantity of light reflected differs according to the different density of the medium behind the body. And that it is not reflected by impinging upon the particles which constitute the surface of the medium behind it, is evident, because the strongest reflection of all at the second surface of a body, is when there is a vacuum behind it. This therefore wants no farther proof.

174 Supposition of a repulsive force;

II. It has been thought by some, that it is reflected at the first surface of a body, by a repulsive force equally diffused over it: and at the second, by an attractive force.

175 objected to.

1. If there be a repulsive force diffused over the surface of bodies that repels rays of light at all times, then, since by increasing the obliquity of a ray we diminish its perpendicular force (which is that only whereby it must make its way through this repulsive force), however weakly that force may be supposed to act, rays of light may be made to fall with so great a degree of obliquity on the reflecting surface, that there shall be a total reflection of them there, and not one particle of light be able to make its way through: which is contrary to observation; the reflection of light at the first surface of a transparent body being never total in any obliquity whatever. The hypothesis therefore in this particular must be false.

176 Attractive force supposed;

2. As to the reflection at the second surface by the attractive force of the body; this may be considered in two respects: first, when the reflection is total; secondly, when it is partial.

And, first, In cases where the reflection is total, the cause of it is undoubtedly that same attractive force by which light would be refracted in passing out of the same body. This is manifest from that analogy which is observable between the reflection of light at this second surface, and its refraction there. For, otherwise, what can be the reason that the total reflection should begin just when the obliquity of the incident

cident ray, at its arrival at the second surface, is such, that the refracted angle ought to be a right one; or when the ray, were it not to return in reflection, ought to pass on parallel to the surface, without going from it? For in this case it is evident, that it ought to be returned by this very power, and in such manner that the angle of reflection shall be equal to the angle of incidence; just as a stone thrown obliquely from the earth, after it is so far turned out of its course by the attraction of the earth, as to begin to move horizontally, or parallel to the surface of the earth, is then by the same power made to return in a curve similar to that which is described in its departure from the earth, and so falls with the same degree of obliquity that it was thrown with.

178 Objected to.

But, secondly, As to the reflection at the second surface, when it is partial; an attractive force uniformly spread over it, as the maintainers of this hypothesis conceive it to be, can never be the cause thereof. Because it is inconceivable, that the same force, acting in the same circumstances in every respect, can sometimes reflect the violet-coloured rays, and transmit the red, and at other times reflect the red and transmit the violet.'

We have stated this objection, because it is our business to conceal no plausible opinions: but it is not valid; for in each colour, the reflection takes place at that angle, and no other, where the refraction of *that* ray would make it parallel to the posterior surface.

This partial reflection and refraction is a great difficulty in all the attempts which have been made to give a mechanical explanation of the phenomena of optics. It is equally a desideratum in that explanation which was proposed by Huygens, and, since his time, revived by Euler, by means of the undulations of an elastic fluid, although a vague consideration of undulatory motions seems to offer a very specious analogy. But a *rigid* application of such *knowledge* as we have acquired of such motions, will convince any unprejudiced mathematician, that the phenomena of undulation are essentially dissimilar to the phenomena of light. The inflection of light, and its refraction, equally demonstrate that light *is acted on* by moving forces in a direction perpendicular to the surface; and it is equally demonstrable that such forces must, in proper circumstances, produce reflections precisely such as we observe. The only difficulty is to show how there can be forces which produce both reflection and refraction, in circumstances which are similar. The fact is, that such effects are produced: the first logical inference is, that with respect to the light which is reflected and that which is refracted, the circumstances are *not* similar; and our attention should be directed to the discovery of that dissimilarity. All the phenomena of combined reflection and refraction should be examined and classed according to their generality, not doubting but that these points of resemblance will lead to the discovery of their causes. Now the experiments of M. Bouguer show that bodies differ extremely in their powers of thus separating light by reflection and refraction, some of them reflecting much more at a given angle than others. It is not therefore *a general property of light* to be partly reflected and partly refracted, but a *distinctive* property of *different* bodies; and since we see that they possess it in *different* degrees, we are authorized to conclude that some bodies *may want it altogether*. We may therefore expect some success by considering how bodies are affected by light, as well as how light is affected by bodies. Now, in all the phenomena of the material world we find bodies connected by mutual forces. We know no case where a body A tends towards a body B, or, in common language, is attracted by it, without, at the same time, the body B tending towards A. This is observed in the phenomena of magnetism, electricity, gravitation, corpuscular attraction, impulse, &c. We should therefore conclude from analogy, that as bodies change the motion of light, light also changes the motion of bodies; and that the particles near the surface are put into vibration by the passage of light through among them. 178

The objection obviated.

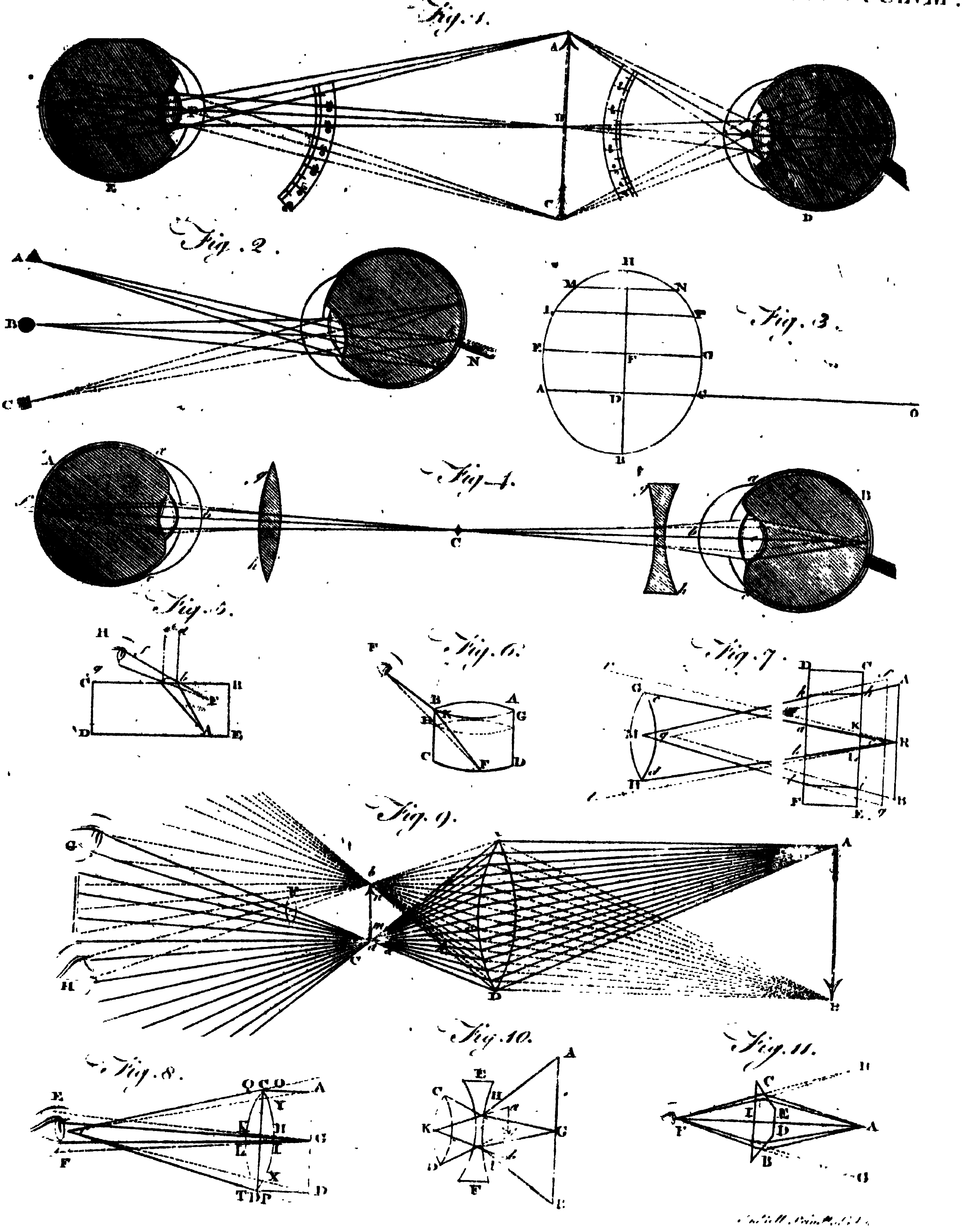
Suppose a parcel of cork balls all hanging as pendulums in a symmetrical order, and that an electrified ball passes through the midst of them; it is very easy to show that it may proceed through this assemblage in various directions with a sinuated motion, and without touching any of them, and that its ultimate direction will have a certain inclination to its primary direction, depending on the outline of the assemblage, just as is observed in the motion of light; and, in the mean time, the cork balls will be variously agitated. Just so must it happen to the particles of a transparent body, if we suppose that they act on the particles of light by mutual attractions and repulsions.

An attentive consideration of what happens here will show us that the superficial particles will be much more agitated than the rest; and thus a stratum be produced, which, in any instant, will act on those particles of light which are then approaching them in a manner different from that in which they will act on similarly situated particles of light, which come into the place of the first in the following moment, when these acting particles of the body have (by their motion of vibration) changed their own situation. Now it is clearly understood, that, in all motions of vibration, such as the motions of pendulums, there is a moment when the body is in its natural situation, as when the pendulum is in the vertical line. This *may* happen in the same instant in each atom of the transparent body. The particles of light which *then* come within the sphere of action may be wholly reflected; in the next moment, particles of light in the very situation of the first may be refracted.

Then will arise a separation of light; and as this will depend on the manner in which the particles of bodies are agitated by it during its passage, and as this again will depend on the nature of the body, that is, on the law of action of those forces which connect the particles with each other, and with the particles of light, it will be different in different bodies. But in all bodies there will be this general resemblance, that the separation will be most copious in great obliquities of incidence, which gives the repulsive forces more time for action, while it diminishes the perpendicular force of the light. Such a resemblance between the phenomena and the legitimate consequences of the assumption (the agitation of the parts of the body), gives us some authority for assigning this as the cause; nor can the assumption

# OPTICS.

Plate CCCLVIII.



Cause of Reflection. tion be called *gratuitous*. To suppose that the particles of the transparent body *are not thus agitated*, would be a most gratuitous contradiction of a law of nature to which we know no other exception.

Thus the objection raised in N° 132. is obviated, because the reflection and refraction are not here conceived as simultaneous, but as successive.

179 Another Hypothesis. III. Some, being apprehensive of the insufficiency of a repulsive and attractive force diffused over the surfaces of bodies and acting uniformly, have supposed, that, by the action of light upon the surface of bodies, the matter of these bodies is put into an undulatory motion; and that where the surface of it is subsiding light is transmitted, and in those places where it is rising light is reflected. But to overlook the objections which we have just made to this theory of undulation, we have only to observe, that, were it admitted, it seems not to advance us one jot farther; for in those cases, suppose where red is reflected and violet transmitted, how comes it to pass that the red impinges only on those parts when the waves are rising, and the violet when they are subsiding?

180 Sir I. Newton's Hypothesis; IV. The next hypothesis that we shall take notice of, is that remarkable one of Sir Isaac Newton's fits of easy reflection and transmission, which we shall now explain and examine.

That author, as far as we can apprehend his meaning in this particular, is of opinion, that light in its passage from the luminous body, is disposed to be alternately reflected by and transmitted through any refracting surface it may meet with; that these dispositions (which he calls *fits of easy reflection and easy transmission*) return successively at equal intervals; and that they are communicated to it at its first emission out of the luminous body it proceeds from, probably by some very subtile and elastic substance diffused through the universe, and that in the following manner. As bodies falling into water, or passing through the air, cause undulations in each, so the rays of light may excite vibrations in this elastic substance. The quickness of which vibrations depending on the elasticity of the medium (as the quickness of the vibrations in the air, which propagate sound, depend solely on the elasticity of the air, and not upon the quickness of those in the sounding body), the motion of the particles of it may be quicker than that of the rays: and therefore, when a ray at the instant it impinges upon any surface, is in that part of a vibration of this elastic substance which conspires with its motion, it may be easily transmitted; and when it is in that part of a vibration which is contrary to its motion, it may be reflected. He further supposes, that when light falls upon the surface of a body, if it be not in a fit of easy transmission, every ray is there put into one, so that when they come at the other side (for this elastic substance, easily pervading the pores of bodies, is capable of the same vibrations within the body as without it), the rays of one colour shall be in a fit of easy transmission, and those of another in a fit of easy reflection, according to the thickness of the body, the intervals of the fits being different in rays of a different kind. This seems to account for the different colours of the bubble and thin plate of air and water, as is obvious enough; and likewise for the reflection of light at the second surface of a thicker body; for the light reflected from thence is also observed to be coloured, and to form rings according to the different thickness of the body, when not intermixed and confounded with other light, as will appear from the following experiment. If a piece of glass be ground concave on one side and convex on the other, both its concavity and convexity having one common centre; and if a ray of light be made to pass through a small hole in a piece of paper held in that common centre, and be permitted to fall on the glass; besides those rays which are regularly reflected back to the hole again, there will be others reflected to the paper, and form coloured rings surrounding the hole, not unlike those occasioned by the reflection of light from thin plates. Laws of Reflection.

It is ever with extreme reluctance that we venture to call in question the doctrines of Newton; but to his theory of reflection there is this insuperable objection, that it explains nothing, unless the *cause* of the fits of more easy reflection and transmission be held as legitimate, namely, that *they are produced by the undulations of another elastic fluid, incomparably more subtile than light*, acting upon it in the way of impulse. The fits themselves are *matters of fact*, and no way different from what we have endeavoured to account for: but to admit this theory of them would be to transgress every rule of philosophizing, as we have shown them to be susceptible of explanation from acknowledged optical laws. 181 Untenable.

## § 2. *Of the Laws of Reflection.* 182

The fundamental law of the reflection of light, is, that in all cases the angle of reflection is equal to the angle of incidence. This is found by experiment to be the case, and besides may be demonstrated mathematically from the laws of percussion in bodies perfectly elastic. The axiom therefore holds good in every case of reflection, whether it be from plane surfaces or spherical ones, and that whether they are convex or concave; and hence the seven following propositions relating to the reflection of light from plane and spherical surfaces may be deduced. The fundamental law of Reflection.

I. Rays of light reflected from a plane surface have the same degree of inclination to one another that their respective incident ones have.—For the angle of reflection of each ray being equal to that of its respective incident one, it is evident, that each reflected ray will have the same degree of inclination to that portion of the surface from whence it is reflected that its incident one has; but it is here supposed, that all those portions of surface from whence the rays are reflected, are situated in the same plane; consequently the reflected rays will have the same degree of inclination to each other that their incident ones have, from whatever part of the surface they are reflected.

II. Parallel rays reflected from a concave surface are rendered converging.—To illustrate this, let AF, CD, EB, (fig. 1.) represent three parallel rays falling upon the concave surface FB, whose centre is C. To the points F and B draw the lines CF, CB; these being drawn from the centre, will be perpendicular to the surface at those points. The incident ray CD also passing through the centre, will be perpendicular to the surface, and therefore will return after reflection in the same line; but the oblique rays AF and Plate CCLIX. 183 Laws of reflection from a concave surface.

Laws of Reflection.

and EB will be reflected into the lines FM and BM, situated on the contrary side of their respective perpendiculars CF and CB. They will therefore proceed converging after reflection towards some point, as M, in the line CD.

III. Converging rays falling on the like surface, are made to converge more.—For, every thing remaining as above, let GF, HB, be the incident rays. Now, because these rays have larger angles of incidence than the parallel ones AF and EB in the foregoing case, their angles of reflection will also be larger than those of the others; they will therefore converge after reflection, suppose in the lines FN and BN, having their point of concourse N farther from the point C than M, that to which the parallel rays AF and EB converged to in the foregoing case; and their precise degree of convergency will be greater than that wherein they converged before reflection.

IV. Diverging rays falling upon the like surface, are, after reflection, parallel, diverging, or converging. If they diverge from the focus of parallel rays, they then become parallel; if from a point nearer to the surface than that, they will diverge, but in a less degree than before reflection; if from a point between that and the centre, they will converge after reflection, and that to some point on the contrary side of the centre, but situated farther from it than the point from which they diverged. If the incident rays diverge from a point beyond the centre, the reflected ones will converge to one on the other side of it, but nearer to it than the point they diverged from; and if they diverge from the centre, they will be reflected thither again.

1. Let them diverge in the lines MF, MB, proceeding from M, the focus of parallel rays; then, as the parallel rays AF and EB were reflected into the lines FM and BM (by Prop. II.), these rays will now on the contrary be reflected into them.

2. Let them diverge from N, a point nearer to the surface than the focus of parallel rays, they will then be reflected into the diverging lines FG and BH which the incident rays GF and HB described that were shown to be reflected into them in the foregoing proposition; but the degree wherein they diverge will be less than that wherein they diverged before reflection.

3. Let them proceed diverging from X, a point between the focus of parallel rays and the centre; they then make less angles of incidence than the rays MF and MB, which became parallel by reflection: they will consequently have less angles of reflection, and proceed therefore converging towards some point, as Y; which point will always fall on the contrary side of the centre, because a reflected ray always falls on the contrary side of the perpendicular with respect to that on which its incident one falls; and of consequence it will be farther distant from the centre than X.

4. If the incident ones diverge from Y, they will, after reflection, converge to X; those which were the incident rays in the former case being the reflected ones in this. And, lastly,

5. If the incident rays proceed from the centre, they fall in with their respective perpendiculars; and for that reason are reflected thither again.

V. Parallel rays reflected from the convex surface are rendered diverging.—For, let AB, GD, EF, (fig. 2.) be three parallel rays falling upon the convex surface BF, whose centre of convexity is C, and let one of them, viz. GD, be perpendicular to the surface. Through B, D, and F, the points of reflection, draw the lines CV, CG, and CT; which, because they pass through the centre, will be perpendicular to the surface at these points. The incident ray GD being perpendicular to the surface, will return after reflection in the same line, but the oblique ones AB and EF in the lines BK and FL, situated on the contrary side of their respective perpendiculars BV and FT. They will therefore diverge, after reflection, as from some point M in the line GD produced; and this point will be in the middle between D and C.

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Plate CCCLIX.

184 From a convex surface.

VI. Diverging rays reflected from the like surface are rendered more diverging. For, every thing remaining as above, let GB, GF, be the incident rays. These having larger angles of incidence than the parallel ones AB and EF in the preceding case, their angles of reflection will also be larger than theirs: they will therefore diverge after reflection, suppose in the lines BP and FQ, as from some point N, farther from C than the point M; and the degree wherein they will diverge will be greater than that wherein they diverged before reflection.

VII. Converging rays reflected from the like surface, are parallel, converging, or diverging. If they tend towards the focus of parallel rays, they then become parallel; if to a point nearer the surface than that, they converge, but in a less degree than before reflection; if to a point between that and the centre, they will diverge after reflection, as from some point on the contrary side of the centre, but situated farther from it than the point they converged to: if the incident rays converge to a point beyond the centre, the reflected ones will diverge as from one on the contrary side of it, but nearer to it than the point to which the incident ones converged; and if the incident rays converge towards the centre, the reflected ones will proceed as from thence.

1. Let them converge in the lines KB and LF, tending towards M, the focus of parallel rays; then, as the parallel rays AB, EF were reflected into the lines BK and FL (by Prop. V), those rays will now on the contrary be reflected into them.

2. Let them converge in the lines PB, QF, tending towards N a point nearer the surface than the focus of parallel rays, they will then be reflected into the converging lines BG and FG, in which the rays GB, GF proceeded that were shown to be reflected into them by the last proposition: but the degree wherein they will converge will be less than that wherein they converged before reflection.

3. Let them converge in the lines RB and SF proceeding towards X, a point between the focus of parallel rays and the centre; their angles of incidence will then be less than those of the rays KB and LF, which became parallel after reflection: their angles of reflection will therefore be less; on which account they must necessarily diverge, suppose in the lines BH and FI, from some point, as Y; which point (by Prop. IV.) will fall on the contrary side of the centre.

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centre with respect to X, and will be farther from it than that.

4. If the incident rays tend towards Y, the reflected ones will diverge as from X; those which were the incident ones in one case being the reflected ones in the other.

5. Lastly, If the incident rays converge towards the centre, they fall in with their respective perpendiculars; on which account they proceed after reflection as from the centre.

We have already observed, that in some cases there is a very great reflection from the second surface of a transparent body. The degree of inclination necessary to cause a total reflection of a ray at the second surface of a medium, is that which requires that the refracted angle (supposing the ray to pass out there) should be equal to or greater than a right one; and consequently it depends on the refractive power of the medium through which the ray passes, and is therefore different in different media. When a ray passes through glass surrounded with air, and is inclined to its second surface under an angle of 42 degrees or more, it will be wholly reflected there. For, as 11 is to 17 (the ratio of refraction out of glass into air), so is the sine of an angle of 42 degrees to a fourth number that will exceed the sine of a right angle. From hence it follows, that when a ray of light arrives at the second surface of a transparent substance with as great or a greater degree of obliquity than that which is necessary to make a total reflection, it will there be all returned back to the first: and if it proceeds towards that with as great an obliquity as it did towards the other (which it will do if the surfaces of the medium be parallel to each other), it will there be all reflected again, &c. and will therefore never get out, but pass from side to side, till it be wholly suffocated and lost within the body.—From hence may arise an obvious inquiry, how it comes to pass, that light falling very obliquely upon a glass window from without, should be transmitted into the room. In answer to this it must be considered, that however obliquely a ray falls upon the surface of any medium whose sides are parallel (as those of the glass in a window are), it will suffer such a degree of refraction in entering there, that it shall fall upon the second with a less obliquity than that which is necessary to cause a total reflection. For instance, let the medium be glass, as supposed in the present case: then, as 17 is to 11 (the ratio of refraction out of air into glass), so is the sine of the largest angle of incidence with which a ray can fall upon any surface to the sine of a less angle than that of total reflection. And therefore, if the sides of the glass be parallel, the obliquity with which a ray falls upon the first surface, cannot be so great, but that it shall pass the second without suffering a total reflection there.

When light passes out of a denser into a rarer medium, the nearer the second medium approaches the first in density (or more properly in its refractive power), the less of it will be refracted in passing from one to the other; and when their refracting powers are equal, all of it will pass into the second medium.

185 The preceding propositions demonstrated mathematically.

The above propositions may be all mathematically demonstrated in the following manner:

Prop. I. Of the reflection of rays from a plane surface.

"When rays fall upon a plane surface, if they diverge, the focus of the reflected rays will be at the same distance behind the surface, that the radiant point is before it: if they converge, it will be at the same distance before the surface that the imaginary focus of the incident rays is behind it."

This proposition admits of two cases.

Case 1. Of diverging rays.

Plate CCCLIX.

Dem. Let AB, AC, (fig. 3.) be two diverging rays incident on the plane surface DE, the one perpendicularly, the other obliquely: the perpendicular one AB will be reflected to A, proceeding as from some point in the line AB produced; the oblique one AC will be reflected into some line as CF, such that the point G, where the line FG produced intersects the line AB produced also, shall be at an equal distance from the surface DE with the radiant A. For the perpendicular CH being drawn, ACH and HCF will be the angles of incidence and reflection; which being equal, their complements ACB and FCE are so too: but the angle BCG is equal to FCE, as being vertical to it: therefore in the triangles ABC and GBC the angles at C are equal, the side BC is common, and the angles at B are also equal to each other, as being right ones; therefore the lines AB and BG, which respect the equal angles at C, are also equal; and consequently the point G, the focus of the incident rays AB, AC, is at the same distance behind the surface, that the point A is before it. *Q. E. D.*

Case 2. Of converging rays.

This is the converse of the former case. For supposing FC and AB to be two converging incident rays, CA and BA will be the reflected ones (the angles of incidence in the former case being now the angles of reflection, and *vice versa*), having the point A for their focus; but this, from what was demonstrated above, is at an equal distance from the reflecting surface with the point G, which in this case is the imaginary focus of the incident rays FC and AB.

Obs. It is not here, as in the refraction of rays in passing through a plane surface, where some of the refracted rays proceed as from one point, and some as from another: but they all proceed after reflection as from one and the same point, however obliquely they may fall upon the surface; for what is here demonstrated of the ray AC holds equally of any other, as AI, AK, &c.

The case of parallel rays incident on a plane surface is included in this proposition: for in that case we are to suppose the radiant to be at an infinite distance from the surface, and then by the proposition the focus of the reflected rays will be so too; that is, the rays will be parallel after reflection, as they were before.

Prop. II. Of the reflection of parallel rays from a spherical surface.

"When parallel rays are incident upon a spherical surface, the focus of the reflected rays will be the middle point between the centre of convexity and the surface."

This proposition admits of two cases.

Case 1. Of parallel rays falling upon a convex surface.

Dem. Let AB, DH, (fig. 4.) represent two parallel rays incident on the convex surface BH, the one perpendicularly, the other obliquely; and let C be the centre of convexity; suppose HE to be the reflected ray of the oblique incident one DH proceeding as from F,

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a point in the line AB produced. Through the point H draw the line CI, which will be perpendicular to the surface at that point; and the angles DHI and IHE, being the angles of incidence and reflection, will be equal. To the former of these, the angle HCF is equal, the lines AC and DH being parallel; and to the latter the angle CHF, as being vertical; wherefore the triangle CFH is isosceles, and consequently the sides CF and FH are equal: but supposing BH to vanish, FH is equal to FB; and therefore upon this supposition FC and FB are equal, that is, the focus of the reflected rays is the middle point between the centre of convexity and the surface. *Q. E. D.*

Case 2. Of parallel rays falling upon a concave surface.

Plate CCCLIX.

Dem. Let AB, DH, (fig. 5.) be two parallel rays incident, the one perpendicularly, the other obliquely, on the concave surface BH, whose centre of concavity is C. Let BF and HF be the reflected rays meeting each other in F; this will be the middle point between B and C. For drawing through C the perpendicular CH, the angles DHC and FHC, being the angles of incidence and reflection, will be equal, to the former of which the angle HCF is equal, as alternate; and therefore the triangle CFH is isosceles. Wherefore CF and FH are equal: but if we suppose BH to vanish, FB and FH are also equal, and therefore CF is equal to FB; that is, the focal distance of the reflected rays is the middle point between the centre and the surface. *Q. E. D.*

Obs. It is here observable, that the farther the line DH, either in fig. 4. or 5. is taken from AB, the nearer the point F falls to the surface. For the farther the point H recedes from B, the larger the triangle CFH will become; and consequently, since it is always an isosceles one, and the base CH, being the radius, is everywhere of the same length, the equal legs CF and FH will lengthen; but CF cannot grow longer unless the point F approach towards the surface. And the farther H is removed from B, the faster F approaches to it.

This is the reason, that whenever parallel rays are considered as reflected from a spherical surface, the distance of the oblique one from the perpendicular one is taken so small with respect to the focal distance of that surface, that without any physical error it may be supposed to vanish.

186 Reflected rays from a spherical surface never proceed from the same point.

From hence it follows, that if a number of parallel rays, as AB, CD, EG, &c. fall upon a convex surface, (as fig. 6.) and if BA, DK, the reflected rays of the incident ones AB, CD, proceed as from the point F, those of the incident ones CD, EG, viz. DK, GL, will proceed as from N, those of the incident ones EG, HI, as from O, &c. because the farther the incident ones CD, EG, &c. are from AB, the nearer to the surface are the points F, *f*, *f*, in the line BF, from which they proceed after reflection; so that properly the foci of the reflected rays BA, DK, GL, &c. are not in the line AB produced, but in a curve line passing through the points F, N, O, &c.

The same is applicable to the case of parallel rays reflected from a concave surface, as expressed by the pricked lines on the other half of the figure, where PQ, RS, TV, are the incident rays; QF, S*f*, V*f*, the reflected ones, intersecting each other in the points X, Y, and F; so that the foci of those rays are not in the line FB, but in a curve passing through those points.

187 Rays proceeding from one point, and falling on a parabolic concave surface, are all reflected from one point.

Had the surface BH in fig. 4. or 5. been formed by the revolution of a parabola about its axis having its focus in the point F, all the rays reflected from the convex surface would have proceeded as from the point F, and those reflected from the concave would have fallen upon it, however distant their incident ones AB, DH, might have been from each other. For in the parabola, all lines drawn parallel to the axis make angles with the tangents to the points where they cut the parabola (that is, with the surface of the parabola) equal to those which are made with the same tangents by lines drawn from thence to the focus; therefore, if the incident rays describe those parallel lines, the reflected ones will necessarily describe these other, and so will all proceed as from, or meet in, the same point.

Prop. III. Of the reflection of diverging and converging rays from a spherical surface.

188 Proportional distance of the focus of rays reflected from a spherical surface.

"When rays fall upon any spherical surface, if they diverge, the distance of the focus of the reflected rays from the surface is to the distance of the radiant point from the same (or, if they converge, to that of the imaginary focus of the incident rays), as the distance of the focus of the reflected rays from the centre is to the distance of the radiant point (or imaginary focus of the incident rays) from the same."

This proposition admits of ten cases.

Case 1. Of diverging rays falling upon a convex surface.

Dem. Let RB, RD, (fig. 7.) represent two diverging rays flowing from the point R as from a radiant, and falling the one perpendicularly, the other obliquely, on the convex surface BD, whose centre is C. Let DE be the reflected ray of the incident one RD, produce ED to F, and through R draw the line RH parallel to FE till it meets CD produced in H. Then will the angle RHD be equal to EDH the angle of reflection, as being alternate to it, and therefore equal also to RDH which is the angle of incidence; wherefore the triangle DRH is isosceles, and consequently DR is equal to RH. Now the lines FD and RH being parallel, the triangles FDC and RHC are similar, (or, to express it in Euclid's way, the sides of the triangle RHC are cut proportionably, 2 Elem. 6.): and therefore FD is to RH, or its equal RD, as CF to CR; but BD vanishing, FD and RD differ not from FB and RB: wherefore FB is to RB also, as CF to CR; that is, the distance of the focus from the surface is to the distance of the radiant point from the same, as the distance of the focus from the centre is to the distance of the radiant from thence. *Q. E. D.*

Case 2. Of converging rays falling upon a concave surface.

Dem. Let KD and CB be the converging incident rays having their imaginary focus in the point R, which was the radiant in the foregoing case. Then as RD was in that case reflected into DE, KD will in this be reflected into DF; for, since the angles of incidence in both cases are equal, as they are by being vertical, the angles of reflection will be so too; so that F will be the focus of the reflected rays: but it was

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was there demonstrated, that FB is to RB as CF to CR; that is, the distance of the focus from the surface is to the distance (in this case) of the imaginary focus of the incident rays, as the distance of the focus from the centre is to the distance of the imaginary focus of the incident rays from the same. *Q. E. D.*

Case 3. Of converging rays falling upon a convex surface, and tending to a point between the focus of parallel rays and the centre.

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Dem. Let BD (fig. 8.) represent a convex surface whose centre is C, and whose focus of parallel rays is P; and let AB, KD, be two converging rays incident upon it, and having their imaginary focus at R, a point between P and C. Now because KD tends to a point between the focus of parallel rays and the centre, the reflected ray DE will diverge from some point on the other side the centre, suppose F; as explained above (p. 308.) under Prop. 7. Through D draw the perpendicular CD and produce it to H; then will KDH and HDE be the angles of incidence and reflection, which being equal, their vertical ones RDC and CDF will be so too, and therefore the vertex of the triangle RDF is bisected by the line DC: wherefore (3 El. 6.) FD and DR, or BD vanishing, FB and BR are to each other as FC to CR; that is, the distance of the focus of the reflected rays is to that of the imaginary focus of the incident ones, as the distance of the former from the centre is to the distance of the latter from the same. *Q. E. D.*

Case 4. Of diverging rays falling upon a concave surface, and proceeding from a point between the focus of parallel rays and the centre.

Dem. Let RB, RD, (fig. 8.) be the diverging rays incident upon the concave surface BD, having their radiant point in the point R, the imaginary focus of the incident rays in the foregoing case. Then as KD was in that case reflected into DE, RD will now be reflected into DF. But it was there demonstrated, that FB and RB are to each other as CF to CR; that is, the distance of the focus is to that of the radiant as the distance of the former from the centre is to the distance of the latter from the same. *Q. E. D.*

The angles of incidence and reflection being equal, it is evident, that if, in any case, the reflected ray be made the incident one, the incident will become the reflected one; and therefore the four following cases may be considered respectively as the converse of the four foregoing; for in each of them the incident rays are supposed to coincide with the reflected ones in the other. Or they may be demonstrated independently of them, as follows.

Case 5. Of converging rays falling upon a convex surface, and tending to a point nearer the surface than the focus of parallel rays.

Dem. Let ED, RB (fig. 7.) be the converging rays incident upon the convex surface BD whose centre is C, and focus of parallel rays is P; and let the imaginary focus of the incident rays be at F, a point between P and B; and let DR be the reflected ray. From C and R draw the lines CH, RH, the one passing through D, the other parallel to FE. Then will the angle RHD be equal to HDE the angle of incidence, as alternate to it; and therefore equal to HDR, the angle of reflection: wherefore the triangle HDR is isosceles, and consequently DR is equal to RH. Now the lines FD and RH being parallel, the triangles FDC and RHC are similar; and therefore RH, or RD, is to FD as CR to CF: but BD vanishing, RD and FD coincide with RB and FB, wherefore RB is to FB as CR to CF; that is, the distance of the focus from the surface is to the distance of the imaginary focus of the incident rays, as the distance of the focus from the centre is to the distance of the imaginary focus of the incident rays from the same. *Q. E. D.*

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Case 6. Of diverging rays falling upon a concave surface, and proceeding from a point between the focus of parallel rays and the surface.

Dem. Let FD and FB represent two diverging rays flowing from the point F as a radiant, which was the imaginary focus of the incident rays in the foregoing case. Then as ED was in that case reflected into DR, FD will be reflected into DK (for the reason mentioned in Case 2.), so that the reflected ray will proceed as from the point R: but it was demonstrated in the case immediately foregoing, that RB is to FB as CR to CF; that is, the distance of the focus from the surface is to that of the radiant from the same, as the distance of the former from the centre is to that of the latter from the same. *Q. E. D.*

Case 7. Of converging rays falling upon a convex surface, and tending towards a point beyond the centre.

Dem. Let AB, ED (fig. 8.) be the incident rays tending to F, a point beyond the centre C, and let DK be the reflected ray of the incident one ED. Then because the incident ray ED tends to a point beyond the centre, the reflected ray DK will proceed as from one on the contrary side, suppose R; as explained above under Prop. VII. Through D draw the perpendicular CD, and produce it to H. Then will EDH and HDK be the angles of incidence and reflection; which being equal, their vertical ones CDF and CDR will be so too: consequently the vertex of the triangle FDR is bisected by the line CD: wherefore, RD is to DF, or (3 Elem. 6.) BD vanishing, RB is to BF as RC to CF; that is, the distance of the focus of the reflected rays is to that of the imaginary focus of the incident rays, as the distance of the former from the centre is to the distance of the latter from the same. *Q. E. D.*

Case 8. Of diverging rays falling upon a concave surface, and proceeding from a point beyond the centre.

Dem. Let FB, FD, be the incident rays having their radiant in F, the imaginary focus of the incident rays in the foregoing case. Then as ED was in that case reflected into DK, FD will now be reflected into DR; so that R will be the focus of the reflected rays. But it was demonstrated in the foregoing case, that RB is to FB as RC to CF; that is, the distance of the focus of the reflected rays from the surface is to the distance of the radiant from the same, as the distance of the focus of the reflected rays from the centre is to the distance of the radiant from thence. *Q. E. D.*

The two remaining cases may be considered as the converse of those under Prop. II. (p. 309, 310.), because the

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the incident rays in these are the reflected ones in them; or they may be demonstrated in the same manner with the foregoing, as follows.

Case 9. Converging rays falling upon a convex surface, and tending to the focus of parallel rays, become parallel after reflection.

Plate CCCLIX.

Dem. Let ED, RB (fig. 7.) represent two converging rays incident on the convex surface BD, and tending towards F, which we will now suppose to be the focus of parallel rays: and let DR be the reflected ray, and C the centre of convexity of the reflecting surface. Through C draw the line CD, and produce it to H, drawing RH parallel to ED produced to F. Now it has been demonstrated (Case 5. where the incident rays are supposed to tend to the point F), that RB is to FB as RC to CF; but F in this Case being supposed to be the focus of parallel rays, it is the middle point between C and B (by Prop. II.) and therefore FB and FC are equal; and consequently the two other terms in the proportion, *viz* RB and RC, must be so too; which can only be upon the supposition that R is at an infinite distance from B; that is, that the reflected rays BR and DR be parallel. *Q. E. D.*

Case 10. Diverging rays falling upon a concave surface, and proceeding from the focus of parallel rays, become parallel after reflection.

Dem. Let RD, RB, (fig. 8.) be two diverging rays incident upon the concave surface BD, as supposed in Case 4. where it was demonstrated that FB is to RB as CF to CR. But in the present case RB and CR are equal, because R is supposed to be the focus of parallel rays; therefore FB and FC are so too; which cannot be unless F be taken at an infinite distance from B; that is, unless the reflected rays BF and DF be parallel. *Q. E. D.*

Obs. It is here observable, that in the case of diverging rays falling upon a convex surface (see fig. 7.), the farther the point D is taken from B, the nearer the point F, the focus of the reflected rays, approaches to B, while the radiant R remains the same. For it is evident from the curvature of a circle, that the point D (fig. 9.) may be taken so far from B, that the reflected ray DE shall proceed as from F, G, H, or even from B, or from any point between B and R; and the farther it is taken from B, the faster the point from which it proceeds approaches towards R: as will easily appear if we draw several incident rays with their respective reflected ones, in such manner that the angles of reflection may be all equal to their respective angles of incidence, as is done in the figure. The like is applicable to any of the other cases of diverging or converging rays incident upon a spherical surface. This is the reason, that, when rays are considered as reflected from a spherical surface, the distance of the oblique rays from the perpendicular one is taken so small, that it may be supposed to vanish.

From hence it follows, that if a number of diverging rays are incident upon the convex surface BD at the several points B, D, D, &c. they shall not proceed after reflection as from any point in the line RB produced, but as from a curve line passing through the several points F, *f*, *f*, &c. The same is applicable in all the other cases.

Had the curvature BD (fig. 7.) been hyperbolical, having its foci in R and F, then R being the radiant (or the imaginary focus of incident rays), F would have been the focus of the reflected ones, and *vice versa*, however distant the points B and D might be taken from each other. In like manner, had the curve BD (fig. 8) been elliptical, having its foci in F and R, the one of these being made the radiant (or imaginary focus of incident rays), the other would have been the focus of reflected ones, and *vice versa*. For both in the hyperbola and ellipsis, lines drawn from each of their foci through any point make equal angles with the tangent to that point. Therefore, if the incident rays proceed to or from one of their foci, the reflected ones will all proceed as from or to the other. So that, in order that diverging or converging rays may be accurately reflected to or from a point, the reflecting surface must be formed by the revolution of an *hyperbola* about its longer axis, when the incident rays are such, that their radiant or imaginary focus of incident rays shall fall on one side the surface, and the focus of the reflected ones on the other; when they are both to fall on the same side, it must be formed by the revolution of an *ellipsis* about its longer axis. However, upon account of the great facility with which spherical surfaces are formed, in comparison of that with which surfaces formed by the revolution of any of the conic sections about their axes are made, the latter are very rarely used. Add to this another inconvenience, *viz.* that the foci of these curves being mathematical points, it is but one point of the surface of an object that can be placed in any of them at a time; so that it is only in theory that surfaces formed by the revolution of these curves about their axes render reflection perfect.

189 Method of finding the focal distance of rays reflected from a convex surface.

Now, because the focal distance of rays reflected from a spherical surface cannot be found by the analogy laid down in the third proposition, without making use of the quantity sought; we shall here give an instance whereby the method of doing it in all others will readily appear.

Prob. Let it be required to find the focal distance of diverging rays incident upon a convex surface, whose radius of convexity is 5 parts, and the distance of the radiant from the surface is 20.

Sol. Call the focal distance sought $x$; then will the distance of the focus from the centre be $5-x$, and that of the radiant from the same 25, therefore by Prop. 3. we have the following proportion. *viz.* $x : 20 :: 5-x : 25$; and multiplying extremes together and means together, we have $25x = 100-20x$, which, after due reduction, gives $x = \frac{100}{45}$.

If in any case it should happen that the value of $x$ should be a negative quantity, the focal point must then be taken on the contrary side of the surface to that on which it was supposed that it would fall in stating the problem.

If letters instead of figures had been made use of in the foregoing solution, a general theorem might have been raised, to have determined the focal distance of reflected rays in all cases whatever. See this done in Suppl. to *Gregory's Optics*, 2d Edit. p. 112

Because it was, in the preceding section, observed, that different incident rays, though tending to or from one point, would after refraction proceed to or from different

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different points, a method was there inserted of determining the distinct point which each separate ray entering a spherical surface converges to, or diverges from, after refraction: the same has been observed here with regard to rays reflected from a spherical surface (see Obs. in Case 2. and Case 10.) But the method of determining the distinct point to or from which any given incident ray proceeds after reflection, is much more simple. It is only necessary to draw the reflected ray such, that the angle of reflection may be equal to the angle of incidence, which will determine the point it proceeds to or from in any case whatever.

§ 3. *Of the Appearance of Bodies seen by Light reflected from plane and spherical Surfaces.*

Whatever has been said concerning the appearance of bodies seen by refracted light through lenses, respects also the appearance of bodies seen by reflection. But besides these, there is one thing peculiar to images by reflection, viz. that each point in the representation of an object made by reflection appears situated somewhere in an infinite right line that passes through its correspondent point in the object, and is perpendicular to the reflecting surface.

The truth of this appears sufficiently from the propositions formerly laid down: in each of which, rays flowing from any radiant point, are shown to proceed after reflection to or from some point in a line that passes through the said radiant, and is perpendicular to the reflecting surface. For instance (fig. 1.), rays

Plate CCCLIX. flowing from Y are collected in X, a point in the perpendicular CD, which, being produced, passes through Y: again (fig. 2.), rays flowing from G, proceed, after reflection, as from N, a point in the perpendicular CD, which, being produced, passes through G; and so of the rest.

This observation, however, except where an object is seen by reflection from a plain surface, relates only to those cases where the representation is made by means of such rays as fall upon the reflecting surface with a very small degree of obliquity; because such as fall at a considerable distance from the perpendicular, proceed not after reflection as from any point in that perpendicular, but as from other points situated in a certain curve, as hath already been explained; upon which account these rays are neglected, as making a confused and deformed representation. And therefore it is to be remembered, that however the situation of the eye with respect to the object and reflecting surface may be represented in the following figures, it is to be supposed as situated in such a manner with respect to the object, that rays flowing from thence and entering it after reflection, may be such only as fall with a very small degree of obliquity upon the surface; that is, the eye must be supposed to be placed almost directly behind the object, or between it and the reflecting surface. The reason why it is not always so placed, is only to avoid confusion

190 in the figures.

The appearance of objects reflected from plane surfaces.

I. When an object is seen by reflection from a plane surface, the image of it appears at the same distance behind the surface that the object is placed before it, of the same magnitude therewith, and directly opposite to it.

To explain this, let AB (fig. 10.) represent an object seen by reflection from the plane surface SV; and let the rays AF, AG, be so inclined to the surface, that they shall enter an eye at H after reflection; and let AE be perpendicular to the surface: then, by the observation just mentioned, the point A will appear in some part of the line AE produced, suppose I; that is, the oblique rays AF and AG will proceed after reflection as from that point: and further, because the reflected rays FH, GK, will have the same degree of inclination to one another that their incident ones have, that point must necessarily be at the same distance from the surface that the point A is; the representation therefore of the point A will be at the same distance behind the surface that the point itself is before it, and directly opposite to it: consequently, since the like may be shown of the point B, or of any other, the whole image IM will appear at the same distance behind the surface that the object is before it, and directly opposite to it; and because the lines AI, BM, which are perpendicular to the plain surface, are for that reason parallel to each other, it will also be of the same magnitude therewith. 191

From convex surfaces; and

II. When an object is seen by reflection from a convex surface, its image appears nearer to the surface, and less than the object.

Let AB (fig. 12.) represent the object, SV a reflecting surface whose centre of convexity is C: and let the rays AF, AG, be so inclined to the surface, that after reflection therefrom, they shall enter the eye at H: and let AE be perpendicular to the surface; then will the oblique rays AF, AG, proceed after reflection as from some point in the line AE produced, suppose from I; which point, because the reflected rays will diverge more than the incident ones, must be nearer to the surface then the point A. And since the same is also true of the rays which flow from B, or any other point, the representation IM will be nearer to the surface than the object; and because it is terminated by the perpendiculars AE and BF, which incline to each other, as concurring at the centre, it will also appear less.

From concave surfaces.

III. When an object is seen by reflection from a concave surface, the representation of it is various, both with regard to its magnitude and situation, according as the distance of the object from the reflecting surface is greater or less. 192

1. When the object is nearer to the surface than its focus of parallel rays, the image falls on the opposite side of the surface, is more distant from it, and larger than the object.

Thus, let AB (fig. 13.) be the object, SV the reflecting surface, F the focus of parallel rays, and C its centre. Through A and B, the extremities of the object, draw the lines CE, CR, which will be perpendicular to the surface; and let the rays AR, AG, be incident upon such points of it that they shall be reflected into an eye at H. Now, because the radiant points A and B are nearer the surface than F the focus of parallel rays, the reflected rays will diverge, and will therefore proceed as from some points on the opposite side of the surface; which points, by the observation laid down at the beginning of this section, will be in the perpendiculars AE, BR, produced, suppose in I and M: but they will diverge in a less degree

The Appearance of Bodies seen by Reflection from different Surfaces.

degree than their incident ones (see the proposition just referred to); and therefore the said points will be farther from the surface than the points A and B. The image therefore will be on the opposite side of the surface with respect to the object: it will be more distant than it; and consequently being terminated by the perpendiculars CI and CM, it will also be larger.

2. When the object is placed in the focus of parallel rays, the reflected rays enter the eye parallel; in which case the image ought to appear at an infinite distance behind the reflecting surface: but the representation of it, for the like reasons that were given in the foregoing case, being large and distinct, we judge it not much farther from the surface than the image.

3. When the object is placed between the focus of parallel rays and the centre, the image falls on the opposite side of the centre, is larger than the object, and in an inverted position.

Plate CCCLIX.

Thus let AB (fig. 14.) represent the object, SV the reflecting surface, F its focus of parallel rays, and C its centre. Through A and B, the extremities of the object, draw the lines CE and CN, which will be perpendicular to the surface; and let AR, AG, be a pencil of rays flowing from A. These rays proceeding from a point beyond the focus of parallel rays, will after reflection converge towards some point on the opposite side the centre, which will fall upon the perpendicular EC produced, but at a greater distance from C than the radiant A from which they diverged. For the same reason, rays flowing from B will converge to a point in the perpendicular NC produced, which shall be farther from C than the point B; from whence it is evident, that the image IM is larger than the object AB, that it falls on the contrary side the centre, and that their positions are inverted with respect to each other.

4. If the object be placed beyond the centre of convexity, the image is then formed between the centre and the focus of parallel rays, is less than the object, and its position is inverted.

This proposition is the converse of the foregoing: for as in that case rays proceeding from A were reflected to I, and from B to M; so rays flowing from I and M will be reflected to A and B; if therefore an object be supposed to be situated beyond the centre in IM, the image of it will be formed in AB between that and the focus of parallel rays, will be less than the object, and inverted.

5. If the middle of the object be placed in the centre of convexity of the reflecting surface, the object and its image will be coincident; but the image will be inverted with respect to the object.

That the place of the image and the object should be the same in this case needs little explication; for the middle of the object being in the centre, rays flowing from thence will fall perpendicularly upon the surface, and therefore necessarily return thither again; so that the middle of the image will be coincident with the middle of the object. But that the image should be inverted is perhaps not so clear. To explain this, let AB (fig. 15.) be the object, having its middle point C in the centre of the reflecting surface SV; through the centre and the point R draw the line CR, which will be perpendicular to the reflecting surface; join the points AR and BR, and let AR represent a ray flowing from A; this will be reflected into RB: for C being the middle point between A and B, the angles ARC and CRB are equal; and a ray from B will likewise be reflected to A; and therefore the position of the image will be inverted with respect to that of the object.

In this proposition it is to be supposed, that the object AB is so situated with respect to the reflecting surface, that the angle ACR may be right; for otherwise the angles ARC and BRC will not be equal, and part of the image will therefore fall upon the object and part off.

6. If in any of the three last cases, in each of which the image is formed on the same side of the reflecting surface with the object, the eye be situated farther from the surface than the place where the image falls, the rays of each pencil, crossing each other in the several points of the image, will enter the eye as from a real object situated there; so that the image will appear pendulous in the air between the eye and the reflecting surface, and in the position wherein it is formed, viz. inverted with respect to the object, in the same manner that an image formed by refracted light appears to an eye placed beyond it; which was fully explained under Prop. IV. (p. 304.), and therefore needs not be repeated.

But as what relates to the appearance of the object when the eye is placed nearer to the surface than the image, was not there fully inquired into, that point shall now be more strictly examined under the following case, which equally relates to refracted and reflected light.

7. If the eye be situated between the reflecting surface and the place of the image, the object is then seen beyond the surface; and the farther the eye recedes from the surface towards the place of the image, the more confused, larger, and nearer, the object appears.

To explain this, let AB (fig. 16.) represent the object; IM its image, one of whose points M is formed by the concurrence of the reflected rays DM, EM, &c. which before reflection came from B; the other, I, by the concurrence of DI, EI, &c. which came from A: and let *ab* be the pupil of an eye, situated between the surface DP and the image. This pupil will admit the rays H*a*, K*b*; which, because they are tending towards I, are such as came from A, and therefore the point A will appear diffused over the space RS. In like manner the pupil will also receive into it the reflected rays K*a* and L*b*, which, because they are tending towards M, by supposition came from B; and therefore the point B will be seen spread as it were over the space TV, and the object will seem to fill the space RV; but the representation of it will be confused, because the intermediate points of the object being equally enlarged in appearance, there will not be room for them between the points S and T, but they will coincide in part one with another: for instance, the appearance of that point in the object, whose representation falls upon *c* in the image, will fill the space *m n*; and so of the rest. Now, if the same pupil

The Appearance of Bodies seen by Reflection from different Surfaces.

pupil be removed into the situation *e f*, the reflected rays E *e* and G *f* will then enter the eye, and therefore one extremity of the object will appear to cover the space XY; and because the rays O *f* and L *e* will also enter it in their progress towards M, the point B, from whence they came, will appear to cover ZV; the object therefore will appear larger and more confused than before. And when the eye recedes quite to the image, it sees but one single point of the object, and that appears diffused all over the reflecting surface: for instance, if the eye recedes to the point M, then rays flowing from the point B enter it upon whatever part of the surface they fall; and so for the rest. The object also appears nearer to the surface the farther the eye recedes from it towards the place of the image; probably because, as the appearance of the object becomes more and more confused, its place is not so easily distinguished from that of the reflecting surface itself, till at last when it is quite confused (as it is when the eye is arrived at M) they both appear as one, the surface assuming the colour of the object.

193 The apparent magnitude of an object seen by reflection from a concave surface.

As to the precise apparent magnitude of an object seen after this manner, it is such that the angle it appears under shall be equal to that which the image of the same object would appear under were we to suppose it seen from the same place: that is, the apparent object (for such we must call it, to distinguish it from the image of the same object) and the image subtend equal angles at the eye.

Dem. Here we must suppose the pupil of the eye to be a point only, because the magnitude of that causes small alteration in the apparent magnitude of the object; as we shall see by and by. Let then the point *a* represent the pupil, then will the extreme rays that can enter it be H *a* and K *a*; the object therefore will appear under the angle H *a* K, which is equal to its vertical one M *a* I, under which the image IM would appear were it to be seen from *a*. Again, if the eye be placed in *f*, the object appears under the angle G *f* O equal to I *f* M, which the image subtends at the same place, and therefore the apparent object and image both subtend equal angles at the eye. *Q. E. D.*

Now if we suppose the pupil to have any sensible magnitude, such, suppose, that its diameter may be *a b*; then the object seen by the eye in that situation will appear under the angle HXL, which is larger than the angle H *a* K, under which it appeared before; because the angle at X is nearer than the angle at *a*, to the line IM, which is a subtense common to them both.

From this proposition it follows; that, were the eye close to the surface at K, the real and apparent object would be seen under equal angles (for the real object appears from that place under the same angle that the image does, as will be shown at the end of this section); therefore, when the eye is nearer to the image than that point, the image will subtend a larger angle at it than the object does; and consequently, since the image and apparent object subtend equal angles at the eye, the apparent object must necessarily be seen under a larger angle than the object itself, wherever the eye be placed, between the surface and the image.

As each point in the representation of an object made by reflection is situated somewhere in a right line that passes through its correspondent point in the object, and is perpendicular to the reflecting surface, as was shown in the beginning of this section; we may from hence deduce a most easy and expeditious method of determining both the magnitude and situation of the image in all cases whatever. Thus,

Plate CCCLIX.

Through the extremities of the object AB and the centre C (fig. 17, 18, or 19.) draw the lines AC BC, and produce them as the case requires; these lines will be perpendicular to the reflecting surface, and therefore the extremities of the image will fall upon them. Through F the middle point of the object and the centre, draw the line FC, and produce it till it passes through the reflecting surface; this will also be perpendicular to the surface. Through G, the point where this line cuts the surface, draw the lines AG and BG, and produce them this way or that, till they cross the former perpendiculars; and where they cross, there I and M the extremities of the image will fall. For supposing AG to be a ray proceeding from the point A and falling upon G, it will be reflected to B; because FA is equal to FB, and FG is perpendicular to the reflecting surface; and therefore the representation of the point A will be in BG produced as well as in AC; consequently it will fall on the point I, where they cross each other. Likewise the ray BG will for the same reason be reflected to A; and therefore the representation of the point B will be in AG produced, as well as in some part of BC, that is, in M where they cross. From whence the proposition is clear.

If it happens that the lines will not cross which way soever they are produced, as in (fig. 20), then is the object in the focus of parallel rays of that surface, and has no image formed in the place whatever. For in this case the rays AH, AG, flowing from the point A, become parallel after reflection in the lines HC, GB, and therefore do not flow as to or from any point: in like manner, rays flowing from B are reflected into the parallel lines KB and GA; so that no representation can be formed by such reflection.

From hence we learn another circumstance relating to the magnitude of the image made by reflection; viz. that it subtends the same angle at the vertex of the reflecting surface that the object does. This appears by inspection of the 17th, 18th, or 19th figure, in each of which the angle IGM, which the image subtends at G the vertex of the reflecting surface, is equal to the angle AGB, which the object subtends at the same place; for in the two first of those figures they are vertical, in the third they are the same. And,

Further, The angle ICM, which the image subtends at the centre, is also equal to the angle ACB which the object subtends at the same place; for in the two first figures they are the same, in the last they are vertical to each other.

From whence it is evident, that the object and its image are to each other in diameter, either as their respective distances from the vertex of the reflecting surface, or as their distances from the centre of the same.

Light differently refrangible.

IV. As objects are multiplied by being seen thro' transparent media, whose surfaces are properly disposed, so they may also by reflecting surfaces. Thus,

Plate CCCLIX.

1. If two reflecting surfaces be disposed at right angles, as the surfaces AB, BC, (fig. 21.), an object at D may be seen by an eye at E, after one reflection at F, in the line EF produced; after two reflections, the first at G, the second at H, in the line EH produced; and also, after one reflection made at A, in the line EA produced.

2. If the surfaces be parallel, as AB, CD, (fig. 22.), and the object be placed at E and the eye at F, the object will appear multiplied an infinite number of times: thus it may be seen in the line FG produced, after one reflection at G; in the line FH produced, after two reflections, the first at I, the second at H; and also in FP produced, after several successive reflections of the ray EL, at the points L, M, N, O, and P: and so on *in infinitum*. But the greater the number of reflections are, the weaker their representation will be.

## SECT. IV. *Of the different Refrangibility of Light.*

As this property of light solves a great number of the phenomena which could not be understood by former opticians, we shall give an account of it in the words of Sir Isaac Newton, who first discovered it; especially as his account is much more full, clear, and perspicuous, than those of succeeding writers.

Plate CCCLX.

"In a very dark chamber, at a round hole F (fig. 1.), about one third of an inch broad, made in the shut of a window, I placed a glass prism ABC, whereby the beam of the sun's light, SF, which came in at that hole, might be refracted upwards, toward the opposite wall of the chamber, and there form a coloured image of the sun, represented at PT. The axis of the prism (that is, the line passing through the middle of the prism, from one end of it to the other end, parallel to the edge of the refracting angle) was in this and the following experiments perpendicular to the incident rays. About this axis I turned the prism slowly, and saw the refracted light on the wall, or coloured image of the sun, first to descend, and then to ascend. Between the descent and ascent, when the image seemed stationary, I stopped the prism and fixed it in that posture.

"Then I let the refracted light fall perpendicularly upon a sheet of white paper, MN, placed at the opposite wall of the chamber, and observed the figure and dimensions of the solar image, PT, formed on the paper by that light. This image was oblong, and not oval, but terminated by two rectilinear and parallel sides and two semicircular ends. On its sides it was bounded pretty distinctly; but on its ends very confusedly and indistinctly, the light there decaying and vanishing by degrees. At the distance of 18½ feet from the prism the breadth of the image was about 2⅛ inches, but its length was about 10¼ inches, and the length of its rectilinear sides about 8 inches; and ACB, the refracting angle of the prism, whereby so great a length was made, was 64 degrees. With a less angle the length of the image was less, the breadth remaining the same. It is farther to be observed, that the rays went on in straight lines from the prism to the image, and therefore at their going out of the prism had all that inclination to one another from which the length of the image proceeded. This image PT was coloured, and the more eminent colours lay in this order from the bottom at T to the top at P; red, orange, yellow, green, blue, indigo, violet; together with all their intermediate degrees in a continual succession perpetually varying."

194 Light consists of several sorts of coloured rays differently refrangible.

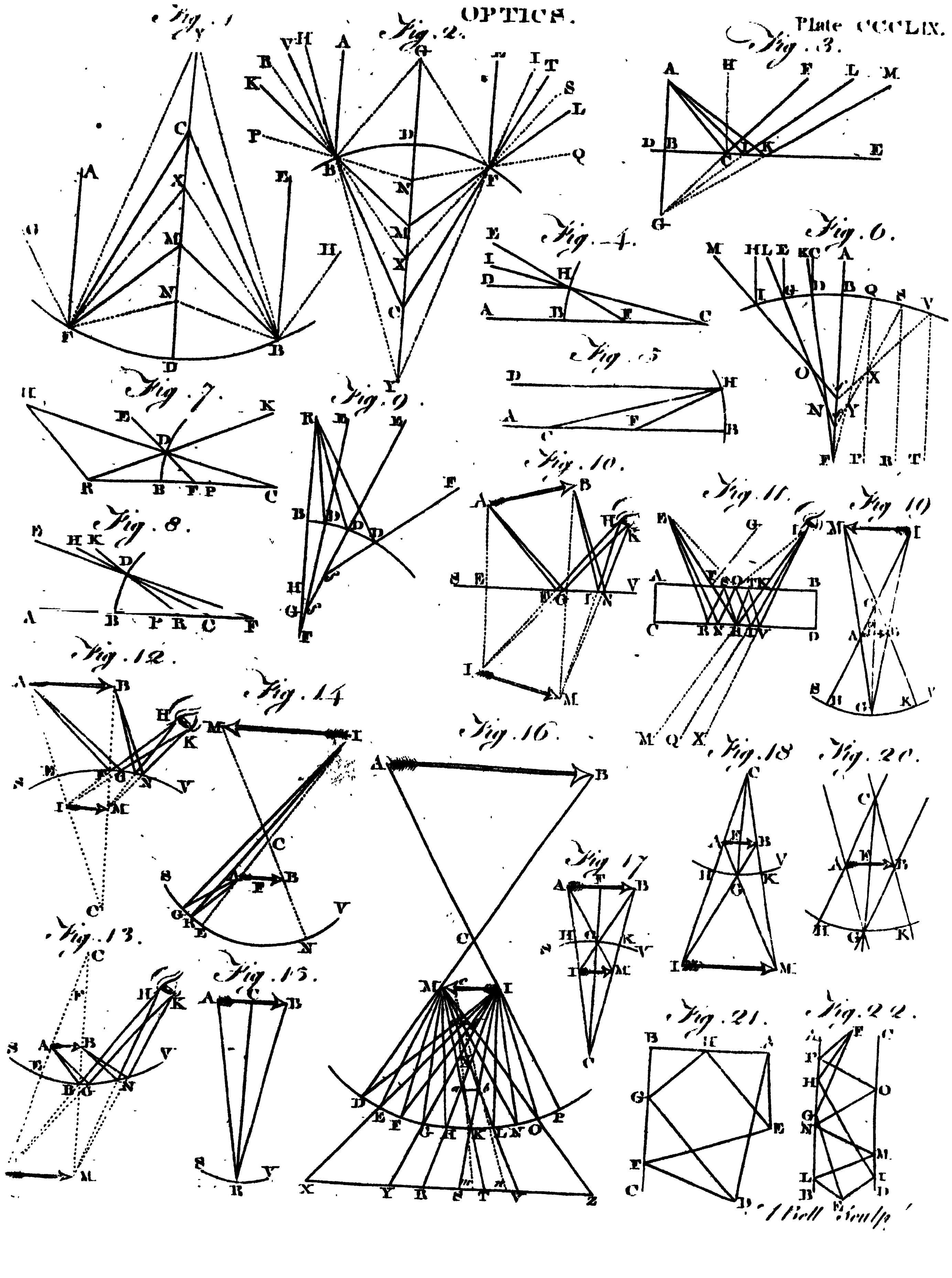
Our author concludes from this experiment, and many more to be mentioned hereafter, "that the light of the sun consists of a mixture of several sorts of coloured rays, some of which at equal incidences are more refracted than others, and therefore are called *more refrangible*. The red at T, being nearest to the place Y, where the rays of the sun would go directly if the prism was taken away, is the least refracted of all the rays; and the orange, yellow, green, blue, indigo, and violet, are continually more and more refracted, as they are more and more diverted from the course of the direct light. For by mathematical reasoning he has proved, that when the prism is fixed in the posture above-mentioned, so that the place of the image shall be the lowest possible, or at the limit between its descent and ascent, the figure of the image ought then to be round like the spot at Y, if all the rays that tended to it were equally refracted. Therefore, seeing by experience it is found that this image is not round, but about five times longer than broad, it follows, that all the rays are not equally refracted. And this conclusion is farther confirmed by the following experiments.

"In the sun-beam SF (fig. 2.), which was propagated into the room thro' the hole in the window-shut EG, at the distance of some feet from the hole, I held the prism ABC in such a posture, that its axis might be perpendicular to that beam: then I looked through the prism upon the hole F, and turning the prism to and fro about its axis to make the image *p t* of the hole ascend and descend, when between its two contrary motions it seemed stationary, I stopped the prism; in this situation of the prism, viewing through it the said hole E, I observed the length of its refracted image *p t* to be many times greater than its breadth; and that the most refracted part thereof appeared violet at *p*; the least refracted red, at *t*; and the middle parts indigo, blue, green, yellow, and orange, in order. The same thing happened when I removed the prism out of the sun's light, and looked through it upon the hole shining by the light of the clouds beyond it. And yet if the refractions of all the rays were equal according to one certain proportion of the sines of incidence and refraction, as is vulgarly supposed, the refracted image ought to have appeared round, by the mathematical demonstration above-mentioned. So then by these two experiments it appears, that in equal incidences there is a considerable inequality of refractions."

For the discovery of this fundamental property of light, which has opened the whole mystery of colours, we see our author was not only beholden to the experiments themselves, which many others had made before him, but also to his skill in geometry; which was absolutely necessary to determine what the figure of the refracted image ought to be upon the old principle of an equal refraction of all the rays: but having

OPTICS.

Plate CCCLIX.



Light differently refrangible.

people in seeing all these experiments would be apt to frame. For the rays, to speak properly, are not coloured. In them there is nothing else than a certain power and disposition to stir up a sensation of this or that colour. For as sound, in a bell or musical string or other sounding body, is nothing but a trembling motion, and in the air nothing but that motion propagated from the object, and in the sensorium it is a sense of that motion under the form of sound; so colours in the object are nothing but a disposition to reflect this or that sort of rays more copiously than the rest: in rays they are nothing but their dispositions to propagate this or that motion into the sensorium; and in the sensorium they are sensations of those motions under the forms of colours. See CHROMATICS.

197 Why the image of the sun, by heterogeneous passing through a prism, is oblong. Plate CCCLX.

"By the mathematical proposition above-mentioned, it is certain that the rays which are equally refrangible do fall upon a circle answering to the sun's apparent disk, which will also be proved by experiment by and by. Now let AG (fig. 5.) represent the circle which all the most refrangible rays, propagated from the whole disk of the sun, will illuminate and paint upon the the opposite wall if they were alone; EL the circle, which all the least refrangible rays would in like manner illuminate if they were alone; BH, CI, DK, the circles which so many intermediate sorts would paint upon the wall, if they were singly propagated from the sun in successive order, the rest being intercepted; and conceive that there are other circles without number, which innumerable other intermediate sorts of rays would successively paint upon the wall, if the sun should successively emit every sort apart. And seeing the sun emits all these sorts at once, they must all together illuminate and paint innumerable equal circles; of all which, being according to their degrees of refrangibility placed in order in a continual series, that oblong spectrum PT is composed, which was described in the first experiment.

"Now if these circles, whilst their centres keep their distances and positions, could be made less in diameter, their interfering one with another, and consequently the mixture of the heterogeneous rays, would be proportionably diminished. Let the circles AG, BH, CI, &c. remain as before; and let *ag*, *bh*, *ci*, &c. be so many less circles lying in a like continual series, between two parallel right lines *ae* and *gl*, with the same distance between their centres, and illuminated with the same sorts of rays: that is, the circle *ag* with the same sort by which the corresponding circle AG was illuminated; and the rest of the circles *bh*, *ci*, *dk*, *el* respectively with the same sorts of rays by which the corresponding circles BH, CI, DK, EL, were illuminated. In the figure PT, composed of the great circles, three of those, AG, BH, CI, are so expanded into each other, that three sorts of rays, by which those circles are illuminated, together with innumerable other sorts of intermediate rays, are mixed at QR in the middle of the circle BH. And the like mixture happens throughout almost the whole length of the figure PT. But in the figure *pt*, composed of the less circles, the three less circles *ag*, *bh*, *ci*, which answer to those three greater, do not extend into one another; nor are there anywhere mingled so much as any two of the three sorts of rays by which those circles are illuminated, and which in the figure PT are all of them intermingled at QR. So then, if we would diminish the mixture of the rays, we are to diminish the diameters of the circles. Now these would be diminished if the sun's diameter, to which they answer, could be made less than it is, or (which comes to the same purpose) if without doors, at great distance from the prism towards the sun, some opaque body were placed with a round hole in the middle of it to intercept all the sun's light, except so much as coming from the middle of his body could pass through that hole to the prism. For so the circles AG, BH, and the rest, would not any longer answer to the whole disk of the sun, but only to that part of it which could be seen from the prism through that hole; that is, to the apparent magnitude of that hole viewed from the prism. But that these circles may answer more distinctly to that hole, a lens is to be placed by the prism to cast the image of the hole (that is, every one of the circles AG, BH, &c.) distinctly upon the paper at PT; after such a manner, as by a lens placed at a window the pictures of objects abroad are cast distinctly upon a paper within the room. If this be done, it will not be necessary to place that hole very far off, no not beyond the window. And therefore, instead of that hole, I used the hole in the window-shut as follows:

Light differently refrangible.

"In the sun's light let into my darkened chamber through a small round hole in my window-shut, at about 10 or 12 feet from the window, I placed a lens MN (fig. 6.), by which the image of the hole F might be distinctly cast upon a sheet of white paper placed at I. Then immediately after the lens I placed a prism ABC, by which the trajected light might be refracted either upwards or sidewise, and thereby the round image which the lens alone did cast upon the paper at I, might be drawn out into a long one with parallel sides, as represented at *pt*. This oblong image I let fall upon another paper at about the same distance from the prism as the image at I, moving the paper either towards the prism or from it, until I found the just distance where the rectilinear sides of the images *pt* become most distinct. For in this case the circular images of the hole, which compose that image, after the manner that the circles *ag*, *bh*, *ci*, &c. do the figure *pt*, were terminated most distinctly, and therefore extended into one another the least that they could, and by consequence the mixture of the heterogeneous rays was now the least of all. The circles *ag*, *bh*, *ci*, &c. which compose the image *pt*, are each equal to the circle at I; and therefore, by diminishing the hole F, or by removing the lens farther from it, may be diminished at pleasure, whilst their centres keep the same distances from each other. Thus, by diminishing the breadth of the image *pt*, the circles of heterogeneal rays that compose it may be separated from each other as much as you please. Yet instead of the circular hole F, it is better to substitute an oblong hole shaped like a parallelogram, with its length parallel to the length of the prism. For if this hole be an inch or two long, and but a 10th or 20th part of an inch broad, or narrower, the light of the image *pt* will be as simple as before, or simpler; and the image being much broader, is therefore fitter to have experiments tried in its light than before.

"Homogeneal light is refracted regularly without any dilatation, splitting, or shattering of the rays; and the

Light differently refrangible.

the confused vision of objects seen through refracting bodies by heterogeneal light, arises from the different refrangibility of several sorts of rays. This will appear by the experiments which will follow. In the middle

198
The image of the sun, by simple and homogeneous light, circular.

of a black paper I made a round hole about a fifth or a sixth part of an inch in diameter. Upon this part I caused the spectrum of homogeneal light, described in the former article, so to fall that some part of the light might pass through the hole in the paper. This transmitted part of the light, I refracted with a prism placed behind the paper: and letting the refracted light fall perpendicularly upon a white paper, two or three feet distant from the prism, I found that the spectrum formed on the paper by this light was not oblong, as when it is made in the first experiment, by refracting the sun's compound light, but was, so far as I could judge by my eye, perfectly circular, the length being nowhere greater than the breadth; which shows that this light is refracted regularly without any dilatation of the rays, and is an ocular demonstration of the mathematical proposition mentioned above.

"In the homogeneal light I placed a paper circle of a quarter of an inch in diameter: and in the sun's unrefracted, heterogeneal, white light, I placed another paper circle of the same bigness; and going from these papers to the distance of some feet, I viewed both circles through a prism. The circle illuminated by the sun's heterogeneal light appeared very oblong, as in the second experiment, the length being many times greater than the breadth. But the other circle, illuminated with homogeneal light appeared circular, and distinctly defined, as when it is viewed by the naked eye; which proves the whole proposition mentioned in the beginning of this article.

199
Vision more distinct in homogeneal than in heterogeneous light.

"In the homogeneal light I placed flies and such like minute objects, and viewing them through a prism I saw their parts as distinctly defined as if I had viewed them with the naked eye. The same objects placed in the sun's unrefracted heterogeneal light, which was white, I viewed also through a prism, and saw them most confusedly defined, so that I could not distinguish their smaller parts from one another. I placed also the letters of a small print one while in the homogeneal light, and then in the heterogeneal; and viewing them through a prism, they appeared in the latter case so confused and indistinct that I could not read them; but in the former, they appeared so distinct that I could read readily, and thought I saw them as distinct as when I viewed them with my naked eye: in both cases, I viewed the same objects through the same prism, at the same distance from me, and in the same situation. There was no difference but in the lights by which the objects were illuminated, and which in one case was simple, in the other compound; and therefore the distinct vision in the former case, and confused in the latter, could arise from nothing else than from that difference in the lights. Which proves the whole proposition.

"In these three experiments, it is farther very remarkable, that the colour of homogeneal light was never changed by the refraction. And as these colours were not changed by refractions, so neither were they by reflections. For all white, gray, red, yellow, green, blue, violet, bodies, as paper, ashes, red lead, orpiment, indigo, bice, gold, silver, copper, grass, blue flowers, violets, bubbles of water tinged with various colours, peacock feathers, the tincture of lignum nephriticum, and such like, in red homogeneal light appeared totally red, in blue light totally blue, in green light totally green, and so of other colours. In the homogeneal light of any colour they all appeared totally of that same colour; with this only difference, that some of them reflected that light more strongly, others more faintly. I never yet found any body which by reflecting homogeneal light could sensibly change its colour.

"From all which it is manifest, that if the sun's light consisted of but one sort of rays, there would be but one colour in the world, nor would it be possible to produce any new colour by reflections and refractions; and by consequence, that the variety of colours depends upon the composition of light.

"The solar image *pt*, formed by the separated rays in the 5th experiment, did in the progress from its end *p*, on which the most refrangible rays fell, unto its end *t*, on which the least refrangible rays fell, appear tinged with this series of colours; violet, indigo, blue, green, yellow, orange, red, together with all their intermediate degrees in a continual succession perpetually varying; so that there appeared as many degrees of colours as there were sorts of rays differing in refrangibility. And since these colours could not be changed by refractions nor by reflections, it follows, that all homogeneal light has its proper colour answering to its degree of refrangibility.

160
Every homogeneal ray is refracted according to one and the same rule.

"Every homogeneal ray considered apart is refracted, according to one and the same rule; so that its sine of incidence is to its sine of refraction in a given ratio: that is, every different coloured ray has a different ratio belonging to it. This our author has proved by experiment, and by other experiments has determined by what numbers those given ratios are expressed. For instance, if an heterogeneal white ray of the sun emerges out of glass into air; or, which is the same thing, if rays of all colours be supposed to succeed one another in the same line AC, and AD (fig. 15.) their common sine of incidence in glass be divided into 50 equal parts, then EF and GH, the sines of refraction into air, of the least and most refrangible rays, will be 77 and 78 such parts respectively. And since every colour has several degrees, the sines of refraction of all the degrees of red will have all intermediate degrees of magnitude from 77 to $77\frac{1}{8}$, of all the degrees of orange from $77\frac{1}{8}$ to $77\frac{1}{5}$, of yellow from $77\frac{1}{5}$ to $77\frac{1}{3}$, of green from $77\frac{1}{3}$ to $77\frac{1}{2}$, of blue from $77\frac{1}{2}$ to $77\frac{2}{3}$, of indigo from $77\frac{2}{3}$ to $77\frac{7}{9}$, and of violet from $77\frac{7}{9}$ of 78."

Plate CCCLX.

PART

# P A R T II.

## Sect. I. *The Application of the foregoing Theory to several natural Phenomena.*

### § 1. *Of the Rainbow.*

THIS beautiful phenomenon hath engaged the attention of all ages. By some nations it hath been deified; though the more sensible part always looked upon it as a natural appearance, and endeavoured, however imperfectly, to account for it. The observations of the ancients and philosophers of the middle ages concerning the rainbow were such as could not have escaped the notice of the most illiterate husbandmen who gazed at the sky; and their various hypotheses deserve no notice. It was a considerable time even after the dawn of true philosophy in this western part of the world, before we find any discovery of importance on this subject. Maurolycus was the first who pretended to have measured the diameters of the two rainbows with much exactness; and he reports that he found that of the inner bow to be 45 degrees, and that of the outer bow 56; from which Descartes takes occasion to observe, how little we can depend upon the observations of those who were not acquainted with the cause of the appearances.

201 Knowledge of the nature of the rainbow a modern discovery.

One *Clichtovæus* (the same, it is probable, who distinguished himself by his opposition to Luther, and who died in 1543) had maintained, that the second bow is the image of the first, as he thought was evident from the inverted order of the colours. For, said he, when we look into the water, all the images that we see reflected by it are inverted with respect to the objects themselves; the tops of the trees, for instance, that stand near the brink, appearing lower than the roots.

That the rainbow is opposite to the sun, had always been observed. It was, therefore, natural to imagine, that the colours of it were produced by some kind of reflection of the rays of light from drops of rain, or vapour. The regular order of the colours was another circumstance that could not have escaped the notice of any person. But, notwithstanding mere reflection had in no other case been observed to produce colours, and it could not but have been observed that refraction is frequently attended with that phenomenon, yet no person seems to have thought of having recourse to a proper refraction in this case, before one *Fletcher* of Breslaw, who, in a treatise which he published in 1571, endeavoured to account for the colours of the rainbow by means of a double refraction and one reflection. But he imagined that a ray of light, after entering a drop of rain, and suffering a refraction both at its entrance and exit, was afterwards reflected from another drop, before it reaches the eye of the spectator. He seems to have overlooked the reflection at the farther side of the drop, or to have imagined that all the bendings of the light within the drop would not make a sufficient curvature to bring the ray of the sun to the eye of the spectator. That he should think of two refractions, was the necessary consequence of his supposing that the ray entered the drop at all. This supposition, therefore, was all the light that he threw upon the subject. B. Porta supposed that the rainbow is produced by the refraction of light in the whole body of rain or vapour, but not in the separate drops.

202 Approach towards it made by Fletcher of Breslaw.

After all, it was a man whom no writers allow to have had any pretensions to philosophy, that hit upon this curious discovery. This was Antonio De Dominis, bishop of Spalatro, whose treatise *De Radiis Visus et Lucis*, was published by J. Bartolus in 1611. He first advanced, that the double refraction of Fletcher, with an intervening reflection, was sufficient to produce the colours of the bow, and also to bring the rays that formed them to the eye of the spectator, without any subsequent reflection. He distinctly describes the progress of a ray of light entering the upper part of the drop, where it suffers one refraction, and after being thereby thrown upon the back part of the inner surface, is from thence reflected to the lower part of the drop; at which place undergoing a second refraction, it is thereby bent, so as to come directly to the eye. To verify this hypothesis, this person (no philosopher as he was) proceeded in a very sensible and philosophical manner. For he procured a small globe of solid glass, and viewing it when it was exposed to the rays of the sun, in the same manner in which he had supposed that the drops of rain were situated with respect to them, he actually observed the same colours which he had seen in the true rainbow, and in the same order.

203 The discovery made by Antonio de Dominis, bishop of Spalatro.

Thus the circumstances in which the colours of the rainbow were formed, and the progress of a ray of light through a drop of water, were clearly understood; but philosophers were a long time at a loss when they endeavoured to assign reasons for all the particular colours, and for the order of them. Indeed nothing but the doctrine of the different refrangibility of the rays of light, which was a discovery reserved for the great Sir Isaac Newton, could furnish a complete solution of this difficulty. De Dominis supposed that the red rays were those which had traversed the least space in the inside of a drop of water, and therefore retained more of their native force, and consequently, striking the eye more briskly, gave it a stronger sensation; that the green and blue colours were produced by those rays, the force of which had been, in some measure, obtunded in passing through a greater body of water; and that all the intermediate colours were composed (according to the hypothesis which generally prevailed at that time) of a mixture of these three primary ones. That the different colours were caused by some difference in the impulse of light upon the eye, and the greater or less impression that was thereby made upon it, was an opinion which had been adopted by many persons, who had ventured to depart from the authority of Aristotle.

Afterwards the same De Dominis observed, that all the rays of the same colour must leave the drop of water in a part similarly situated with respect to the eye,

Of the Rainbow. in order that each of the colours may appear in a circle, the centre of which is a point of the heavens, in a line drawn from the sun through the eye of the spectator. The red rays, he observed, must issue from the drop nearest to the bottom of it, in order that the circle of red may be the outermost, and therefore the most elevated in the bow.

Notwithstanding De Dominis conceived so justly of the manner in which the inner rainbow is formed, he was far from having as just an idea of the cause of the exterior bow. This he endeavoured to explain in the very same manner in which he had done the interior, viz. by one reflection of the light within the drop, preceded and followed by a refraction; supposing only that the rays which formed the exterior bow were returned to the eye by a part of the drop lower than that which transmitted the red of the interior bow. He also supposed that the rays which formed one of the bows came from the superior part of the sun's disk, and those which formed the other from the inferior part of it. He did not consider, that upon those principles, the two bows ought to have been contiguous; or rather, that an indefinite number of bows would have had their colours all intermixed; which would have been no bow at all.

When Sir Isaac Newton discovered the different refrangibility of the rays of light, he immediately applied his new theory of light and colours to the phenomena of the rainbow, taking this remarkable object of philosophical inquiry where De Dominis and Descartes, for want of this knowledge, were obliged to leave their investigations imperfect. For they could give no good reason why the bow should be coloured, and much less could they give any satisfactory account of the order in which the colours appear.

204 The true cause of the colours of the rainbow.

If different particles of light had not different degrees of refrangibility, on which the colours depend, the rainbow, besides being much narrower than it is, would be colourless; but the different refrangibility of differently coloured rays being admitted, the reason is obvious, both why the bow should be coloured, and also why the colours should appear in the order in which they are observed. Let *a* (fig. 8.) be a drop of water, and S a pencil of light; which, on its leaving the drop of water, reaches the eye of the spectator. This ray, at its entrance into the drop, begins to be decomposed into its proper colours; and upon leaving the drop, after one reflection and a second refraction, it is farther decomposed into as many small differently-coloured pencils as there are primitive colours in the light. Three of them only are drawn in this figure, of which the blue is the most, and the red the least, refracted.

Plate CCLX.

The doctrine of the different refrangibility of light enables us to give a reason for the size of a bow of each particular colour. Newton, having found that the sines of refraction of the most refrangible and least refrangible rays, in passing from rain water into air, are in the proportion of 185 to 182, when the sine of incidence is 138, calculated the size of the bow; and he found, that if the sun was only a physical point, without sensible magnitude, the breadth of the inner bow would be 2 degrees; and if to this 30′ were added for the apparent diameter of the sun, the whole breadth would be 2½ degrees. But as the outermost colours, especially the violet, are extremely faint, the breadth of the bow will not in reality appear to exceed two degrees. He finds, by the same principles, that the breadth of the exterior bow, if it was everywhere equally vivid, would be 4° 20′. But in this case there is a greater deduction to be made, on account of the faintness of the light of the exterior bow; so that in fact, it will not appear to be more than 3 degrees broad.

The principal phenomena of the rainbow are all explained on Sir Isaac Newton's principles in the following propositions.

*When the rays of the sun fall upon a drop of rain and enter into it, some of them, after one reflection and two refractions, may come to the eye of a spectator who has his back towards the sun, and his face towards the drop.*

205 Explanation of the phenomena of rainbow on the principles of Newton.

If XY (fig. 9.) is a drop of rain, and the sun shines upon it in any lines *s f*, *s d*, *s a*, &c. most of the rays will enter into the drop; some few of them only will be reflected from the first surface; those rays which are reflected from thence do not come under our present consideration, because they are never refracted at all. The greatest part of the rays then enter the drop, and those passing on to the second surface, will most of them be transmitted through the drop; but neither do those rays which are thus transmitted fall under our present consideration, since they are not reflected. For the rays, which are described in the proposition, are such as are twice refracted and once reflected. However, at the second surface, or hinder part of the drop, at *p g*, some few rays will be reflected, whilst the rest are transmitted; those rays proceed in some such lines as *n r*, *n q*: and coming out of the drop in the lines *r v*, *q t*, may fall upon the eye of a spectator, who is placed anywhere in those lines, with his face towards the drop, and consequently with his back towards the sun, which is supposed to shine upon the drop in the lines *s f*, *s d*, *s a*, &c. These rays are twice refracted and once reflected; they are refracted when they pass out of the air into the drop; they are reflected from the second surface, and are refracted again when they pass out of the drop into the air.

*When rays of light reflected from a drop of rain come to the eye, those are called effectual which are able to excite a sensation.*

*When rays of light come out of a drop of rain, they will not be effectual, unless they are parallel and contiguous.*

There are but few rays that can come to the eye at all: for since the greatest part of those rays which enter the drop XY (fig. 9.) between X and *a*, pass out of the drop through the hinder surface *p g*; only few are reflected from thence, and come out through the nearer surface between *a* and *y*. Now, such rays as emerge, or come out of the drop, between *a* and Y, will be ineffectual, unless they are parallel to one another, as *r v* and *q t* are; because such rays as come out diverging from one another will be so far asunder when they come to the eye, that all of them cannot enter the pupil; and the very few that can enter it will not be sufficient

sufficient to excite any sensation. But even rays, which are parallel, as *r v*, *q t*, will not be effectual, unless there are several of them contiguous or very near to one another. The two rays *r v* and *q t* alone will not be perceived, though both of them enter the eye; for so very few rays are not sufficient to excite a sensation.

*When rays of light come out of a drop of rain after one reflection, those will be effectual which are reflected from the same point, and which entered the drop near to one another.*

Plate CCCLX. Any rays, as *s b* and *c d*, (fig. 10.) when they have passed out of the air into a drop of water, will be refracted towards the perpendiculars *b l*, *d l*; and as the ray *s b* falls farther from the axis *a v* than the ray *c d*, *s b* will be more refracted than *c d*; so that these rays, though parallel to one another at their incidence, may describe the lines *b e* and *d e* after refraction, and be both of them reflected from one and the same point *e*. Now all rays, which are thus reflected from one and the same point, when they have described the lines *e f*, *e g*, and after reflection emerge at *f* and *g*, will be so refracted, when they pass out of the drop into the air, as to describe the lines *f h*, *g i*, parallel to one another. If these rays were to return from *e* in the lines *e b*, *e d*, and were to emerge at *b* and *d*, they would be refracted into the lines of their incidence *b s*, *d c*. But if these rays, instead of being returned in the lines *e b*, *e d*, are reflected from the same point *e* in the lines *e g*, *e f*, the lines of reflection *e g* and *e f* will be inclined both to one another and to the surface of the drop: just as much as the lines *e b* and *e d* are. First, *e b* and *e g* make just the same angle with the surface of the drop: for the angle *b e x*, which *e b* makes with the surface of the drop, is the complement of incidence, and the angle *g e v*, which *e g* makes with the surface, is the complement of reflection; and these two are equal to one another. In the same manner we might prove, that *e d* and *e f* make equal angles with the surface of the drop. Secondly, The angle *b e d* is equal to the angle *f e g*; or the reflected rays *e g*, *e f*, and the incident rays *b e*, *d e*, are equally inclined to each other. For the angle of incidence *b e l* is equal to the angle of reflection *g e l*, and the angle of incidence *d e l* is equal to the angle of reflection *f e l*; consequently, the difference between the angles of incidence is equal to the difference between the angles of reflection, or *b e l*—*d e l*=*g e l*—*f e l*, or *b e d*=*g e f*. Since therefore either the lines *e g*, *e f*, or the lines *e b*, *e d*, are equally inclined both to one another and to the surface of the drop; the rays will be refracted in the same manner, whether they were to return in the lines *e b*, *e d*, or are reflected in the lines *e g*, *e f*. But if they were to return in the lines *e b*, *e d*, the refraction, when they emerge at *b* and *d* would make them parallel. Therefore, if they are reflected from one and the same point *e* in the lines *e g*, *e f*, the refraction, when they emerge at *g* and *f*, will likewise make them parallel.

But though such rays as are reflected from the same point in the hinder part of a drop of rain, are parallel to one another when they emerge, and so have one condition that is requisite towards making them effectual, yet there is another condition necessary; for rays that are effectual, must be contiguous as well as parallel. And though rays, which enter the drop in different places, may be parallel when they emerge, those only will be contiguous which enter it nearly at the same place.

Let XY (fig. 9.) be a drop of rain, *a g* the axis or diameter of the drop, and *s a* a ray of light that comes from the sun and enters the drop at the point *a*. This ray *s a*, because it is perpendicular to both the surfaces, will pass straight through the drop in the line *a g h* without being refracted; but any collateral rays, such as those that fall about *s b*, as they pass through the drop, will be made to converge to their axis, and passing out at *n* will meet the axis at *h*: rays which fall farther from the axis than *s b*, such as those which fall about *s c*, will likewise be made to converge; but then their focus will be nearer to the drop than *h*. Suppose therefore *i* to be the focus to which the rays that fall about *s c* will converge, any ray *s c*, when it has described the line *c o* within the drop, and is tending to the focus *i*, will pass out of the drop at the point *o*. The rays that fall upon the drop about *s d*, more remote still from the axis, will converge to a focus still nearer than *i*, as suppose at *k*. These rays therefore go out of the drop at *p*. The rays, that fall still more remote from the axis, as *s e*, will converge to a focus nearer than *k*, as suppose at *l*; and the ray *s e*, when it has described the line *e o* within the drop, and is tending to *l*, will pass out at the point *o*. The rays that fall still more remote from the axis will converge to a focus still nearer. Thus the ray *s f* will after refraction converge to a focus at *m*, which is nearer than *l*; and having described the line *f n* within the drop, it will pass out to the point *n*. Now here we may observe, that as any rays *s b* or *s c*, fall farther above the axis *s a*, the points *n*, or *o*, where they pass out behind the drop, will be farther above *g*; or that, as the incident ray rises from the axis *s a*, the arc *g n o* increases, till we come to some ray *s d*, which passes out of the drop at *p*; and this is the highest point where any ray that falls upon the quadrant or quarter *a x* can pass out: for any rays *s e*, or *s f*, that fall higher than *s d*, will not pass out on any point above *p*, but at the points *o*, or *n*, which are below it. Consequently, though the arc *g n o p* increases, whilst the distance of the incident ray from the axis *s a* increases, till we come to the ray *s d*; yet afterwards, the higher the ray falls above the axis *s a*, this arc *p o n g* will decrease.

We have hitherto spoken of the points on the hinder part of the drop, where the rays pass out of it; but this was for the sake of determining the points from whence those rays are reflected, which do not pass out behind the drop. For, in explaining the rainbow, we have no farther reason to consider those rays which go through the drop; since they can never come to the eye of a spectator placed anywhere in the lines *r v* or *q t* with his face towards the drop. Now, as there are many rays which pass out of the drop between *g* and *p*, so some few rays will be reflected from thence: and consequently the several points between *g* and *p*, which are the points where some of the rays pass out of the drop, are likewise the points of reflection for the rest which do not pass out. Therefore, in respect of those rays which are reflected we may call *g p* the arc of reflection; and may say, that this arc of

of reflection increases, as the distance of the incident ray from the axis *s a* increases, till we come to the ray *s d*; the arc of reflection is *g n* for the ray *s b*, it is *g o* for the ray *s c*, and *g p* for the ray *s d*. But after this, as the distance of the incident ray from the axis *s a* increases, the arc of reflection decreases; for *o g* less than *p g* is the arc of reflection for the ray *s e*, and *n g* is the arc of reflection for the ray *s f*.

From hence it is obvious, that some one ray, which falls above *s d*, may be reflected from the same point with some other ray which falls below *s d*. Thus, for instance, the ray *s b* will be reflected from the point *n*, and the ray *s f* will be reflected from the same point; and consequently, when the reflected rays *n r*, *n q*, are refracted as they pass out of the drop at *r* and *q*, they will be parallel, by what has been shown in the former part of this proposition. But since the intermediate rays, which enter the drop between *s f* and *s b*, are not reflected from the same point *n*, these two rays alone will be the parallel to one another when they come out of the drop, and the intermediate rays will not be parallel to them. And consequently these rays *r v*, *q t*, though they are parallel after they emerge at *r* and *q*, will not be contiguous, and for that reason will not be effectual; the ray *s d* is reflected from *p*, which has been shown to be the limit of the arc of reflection; such rays as fall just above *s d*, and just below *s d*, will be reflected from nearly the same point *p*, as appears from what has been already shown. These rays therefore will be parallel, because they are reflected from the same point *p*; and they will likewise be contiguous, because they all of them enter the drop at one and the same place very near to *d*. Consequently, such rays as enter the drop at *d*, and are reflected from *p* the limit of the arc of reflection, will be effectual; since, when they emerge at the fore part of the drop between *a* and *y*, they will be both parallel and contiguous.

If we can make out hereafter that the rainbow is produced by the rays of the sun which are thus reflected from drops of rain as they fall whilst the sun shines upon them, this proposition may serve to show us, that this appearance is not produced by *any* rays that fall upon *any part*, and are reflected from any part of those drops: since this appearance cannot be produced by any rays but those which are effectual; and effectual rays must always enter each drop at one certain place in the fore part of it, and must likewise be reflected from one certain place in the hinder surface.

*When rays that are effectual emerge from a drop of rain after one reflection and two refractions, those which are most refrangible will, at their emersion, make a less angle with the incident rays than those do which are least refrangible; and by this means the rays of different colours will be separated from one another.*

Plate CCCLX. Let *f b* and *g i* (fig. 10.) be effectual violet rays emerging from the drop at *f g*; and *f n*, *g p*, effectual red rays emerging from the same drop at the same place. Now, though all the violet rays are parallel to one another, because they are supposed effectual, and though all the red rays are likewise parallel to one another for the same reason; yet the violet rays will not be parallel to the red rays. These rays, as they have different colours, and different degrees of refrangibility, will diverge from one another; any violet ray *g i*, which emerges at *g*, will diverge from any red ray *g p*, which emerges at the same place. Now, both the violet ray *g i*, and the red ray *g p*, as they pass out of the drop of water into the air, will be refracted from the perpendicular *l o*. But the violet ray is more refrangible than the red one; and for that reason *g i*, or the refracted violet ray, will make a greater angle with the perpendicular than *g p* the refracted red ray; or the angle *i g o* will be greater than the angle *p g o*. Suppose the incident ray *s b* to be continued in the direction *s k*, and the violet ray *i g* to be continued backward in the direction *i k*, till it meets the incident ray at *k*. Suppose likewise the red ray *p g* to be continued backwards in the same manner, till it meets the incident ray at *w*. The angle *i k s* is that which the violet ray, or most refrangible ray at its emersion, makes with the incident ray; and the angle *p w s* is that which the red ray, or least refrangible ray at its emersion, makes with the incident ray. The angle *i k s* is less than the angle *p w s*. For, in the triangle, *g w k*, *g w s*, or *p w s*, is the external angle at the base, and *g k w* or *i k s* is one of the internal opposite angles; and either internal opposite angle is less than the external angle at the base. (Euc. B. I. Prop. 16.) What has been shown to be true of the rays *g i* and *g p* might be shown in the same manner of the rays *f b* and *f n*, or of any other rays that emerge respectively parallel to *g i* and *g p*. But all the effectual violet rays are parallel to *g i*, and all the effectual red rays are parallel to *g p*. Therefore the effectual violet rays at their emersion make a less angle with the incident ones than the effectual red ones. And for the same reason, in all the other sorts of rays, those which are most refrangible, at their emersion from a drop of rain after one reflection, will make a less angle with the incident rays, than those do which are less refrangible.

Or otherwise: When the rays *g i* and *g p* emerge at the same point *g*, as they both come out of water into air, and consequently are refracted from the perpendicular, instead of going straight forwards in the line *e g* continued, they will both be turned round upon the point *g* from the perpendicular *g o*. Now it is easy to conceive, that either of these lines might be turned in this manner upon the point *g* as upon a centre, till they became parallel to *s b* the incident ray. But if either of these lines or rays were refracted so much from *g o* as to become parallel to *s b*, the ray so much refracted, would, after emersion, make no angle with *s k*, because it would be parallel to it. And consequently that ray which is most turned round upon the point *g*, or that ray which is most refrangible, will after emersion be nearest parallel to the incident ray, or will make the least angle with it. The same may be proved of all other rays emerging parallel to *g i* and *g p* respectively, or of all effectual rays; those which are most refrangible will after emersion make a less angle with the incident rays, than those do which are least refrangible.

But since the effectual rays of different colours make different angles with *s k* at their emersion, they will be separated from one another: so that if the eye was placed in the beam *f g b i*, it would receive only rays of one colour from the drop *x a g v*; and if it was placed in

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in the beam $f\,g\,n\,p$, it would receive only rays of some other colour.

The angle $s\,w\,p$, which the least refrangible or red rays make with the incident ones when they emerge so as to be effectual, is found by calculation to be 42 degrees 2 minutes. And the angle $s\,k\,i$, which the most refrangible rays make with the incident ones when they emerge so as to be effectual, is found to be 40 degrees 17 minutes. The rays which have the intermediate degrees of refrangibility, make with the incident ones intermediate angles between 42 degrees 2 minutes, and 40 degrees 17 minutes.

*If a line is supposed to be drawn from the centre of the sun through the eye of the spectator, the angle which any effectual ray, after two refractions and one reflection, makes with the incident ray, will be equal to the angle which it makes with that line.*

Plate CCCLX.

Let the eye of the spectator be at $i$, (fig. 10.) and let $q\,t$ be the line supposed to be drawn from the centre of the sun through the eye of the spectator; the angle $g\,i\,t$, which any effectual ray makes with this line, will be equal to the angle $i\,k\,s$, which the same ray makes with the incident ray $s\,b$ or $s\,k$. If $s\,b$ is a ray coming from the centre of the sun, then since $q\,t$ is supposed to be drawn from the same point, these two lines, upon account of the remoteness of the point from whence they are drawn, may be looked upon as parallel to one another. But the right line $k\,i$ crossing these two parallel lines will make the alternate angles equal. (Euc. B. I. Prop. 29.) Therefore $k\,i\,t$ or $g\,i\,t$ is equal to $s\,k\,i$.

*When the sun shines upon the drops of rain as they are falling, the rays that come from those drops to the eye of a spectator, after one reflection and two refractions, produce the primary rainbow.*

206 Two rainbows seen at once.

If the sun shines upon the rain as it falls, there are commonly seen two bows, as AFB, CHD, (fig. 11.); or if the cloud and rain does not reach over that whole side of the sky where the bows appear, then only a part of one or of both bows is seen in that place where the rain falls. Of these two bows, the innermost AFB is the more vivid of the two, and this is called the *primary bow*. The outer part TFY of the primary bow is red, the inner part VEX is violet; the intermediate parts, reckoning from the red to the violet, are orange, yellow, green, blue, and indigo. Suppose the spectator's eye to be at O, and let LOP be an imaginary line drawn from the centre of the sun through the eye of the spectator: if a beam of light S coming from the sun falls upon any drop F; and the rays that emerge at F in the line FO, so as to be effectual, make an angle FOP of 42° 2′ with the line LP; then these effectual rays make an angle of 42° 2′ with the incident rays, by the preceding proposition, and consequently these rays will be red, so that the drop F will appear red. All the other rays, which emerge at F, and would be effectual if they fell upon the eye, are refracted more than the red ones, and consequently will pass above the eye. If a beam of light S falls upon the drop E; and the rays that emerge at E in the line EO, so as to be effectual, make an angle EOP of 40° 17′ with the line LP; then these effectual rays make likewise an angle of 40° 17′ with the incident rays, and the drop E will appear of a violet colour. All the other rays, which emerge at E, and would be effectual if they came to the eye, are refracted less than the violet ones, and therefore pass below the eye. The intermediate drops between F and E will for the same reasons be of the intermediate colours.

Thus we have shown why a set of drops from F to E, as they are falling, should appear of the primary colours, red, orange, yellow, green, blue, indigo, and violet. It is not necessary that the several drops, which produce these colours, should all of them fall at exactly the same distance from the eye. The angle FOP, for instance, is the same whether the distance of the drop from the eye is OF, or whether it is in any other part of the line OF something nearer to the eye. And whilst the angle FOP is the same, the angle made by the emerging and incident rays, and consequently the colour of the drop, will be the same. This is equally true of any other drop. So that although in the figure the drops F and E are represented as falling perpendicularly one under the other, yet this is not necessary in order to produce the bow.

But the coloured line FE, which we have already accounted for, is only the breadth of the bow. It still remains to be shown, why not only the drop F should appear red, but why all the other drops quite from A to B in the arc ATFYB should appear of the same colour. Now it is evident, that wherever a drop of rain is placed, if the angle which the effectual rays make with the line LP is equal to the angle FOP, that is, if the angle which the effectual rays make with the incident rays is 42° 2′, any of those drops will be red, for the same reason that the drop F is of this colour.

If FOP was to turn round upon the line OP, so that one end of this line should always be at the eye, and the other be at P opposite to the sun; such a motion of this figure would be like that of a pair of compasses turning round upon one of the legs OP with the opening FOP. In this revolution the drop F would describe a circle, P would be the centre, and ATFYB would be an arc in this circle. Now since, in this motion of the line and drop OF, the angle made by FO with OP, that is the angle FOP, continues the same; if the sun was to shine upon this drop as it revolves, the effectual rays would make the same angle with the incident rays, in whatever part of the arc ATFYB the drop was to be. Therefore, whether the drop is at A, or at T, or at Y, or at B, or wherever else it is in this whole arc, it would appear red, as it does at F.—The drops of rain, as they fall, are not indeed turned round in this manner: but then, as innumerable of them are falling at once in right lines from the cloud, whilst one drop is at F, there will be others at Y, at T, at B, at A, and in every other part of the arc ATFYB: and all these drops will be red for the same reason that the drop F would have been red, if it had been in the same place. Therefore, when the sun shines upon the rain as it falls, there will be a red arc ATFYB opposite to the sun. In the same manner, because the drop E is violet, we might prove that any other drop, which, whilst it is falling, is in any part of the arc AVEXB, will be violet; and consequently, at the same time that the red arc ATFYB appears, there will likewise

wise be a violet arc AVEXB below or within it. FE is the distance between these two coloured arcs; and from what has been said, it follows, that the intermediate space between these two arcs will be filled up with arcs of the intermediate colours, orange, yellow, blue, green, and indigo. All these coloured arcs together make up the primary rainbow.

*The primary rainbow is never a greater arc than a semicircle.*

Plate CCCLX.

207 Why the arc of the primary rainbow is never greater than a semicircle.

Since the line LOP is drawn from the sun through the eye of the spectator, and since P (fig. 9.) is the centre of the rainbow; it follows, that the centre of the rainbow is always opposite to the sun. The angle FOP is an angle of 42° 2′, as was observed, or F the highest part of the bow is 42° 2′ from P the centre of it. If the sun is more than 42° 2′ high, P the centre of the rainbow, which is opposite to the sun, will be more than 42° 2′ below the horizon; and consequently F the top of the bow, which is only 42° 2′ from P, will be below the horizon; that is, when the sun is more than 42° 2′ high, no primary rainbow will be seen. If the sun is something less than 42° 2′ high, then P will be something less than 42° 2′ below the horizon; and consequently F, which is only 42° 2′ from P, will be just above the horizon; that is, a small part of the bow at this height of the sun will appear close to the ground opposite to the sun. If the sun is 20° high, then P will be 20° below the horizon; and F the top of the bow, being 42° 2′ from P, will be 22° 2′ above the horizon; therefore, at this height of the sun, the bow will be an arc of a circle whose centre is below the horizon; and consequently that arc of the circle which is above the horizon, or the bow, will be less than a semicircle. If the sun is in the horizon, then P, the centre of the bow, will be in the opposite part of the horizon; F, the top of the bow, will be 42° 2′ above the horizon; and the bow itself, because the horizon passes through the centre of it, will be a semicircle. More than a semicircle can never appear; because if the bow was more than a semicircle, P the centre of it must be above the horizon; but P is always opposite to the sun, therefore P cannot be above the horizon, unless the sun is below it; and when the sun is set, or is below the horizon, it cannot shine upon the drops of rain as they fall; and consequently, when the sun is below the horizon, no bow at all can be seen.

*When the rays of the sun fall upon a drop of rain, some of them, after two reflections and two refractions, may come to the eye of a spectator, who has his back towards the sun and his face towards the drop.*

If HGW (fig. 12.) is a drop of rain, and parallel rays coming from the sun, as *z v*, *y w*, fall upon the lower part of it, they will be refracted towards the perpendiculars *v l*, *w l*, as they enter into it, and will describe some such lines as *v h*, *w i*. At *h* and *i* great part of these rays will pass out of the drop; but some of them will be reflected from thence in the lines *h f*, *i g*. At *f* and *g* again, great part of the rays that were reflected thither will pass out of the drop. But these rays will not come to the eye of a spectator at *o*. However, here again all the rays will not pass out; but some few will be reflected from *f* and *g*, in some such lines as *f d*, *g b*; and these, when they emerge out of the drop of water into the air at *b* and *d*, will be refracted from the perpendiculars, and, describing the lines *d t*, *b o*, may come to the eye of the spectator who has his back towards the sun and his face towards the drop.

*These rays, which are parallel to one another after they have been once refracted and once reflected in a drop of rain, will be effectual when they emerge after two refractions and two reflections.*

No rays can be effectual, unless they are contiguous and parallel. From what was said, it appears, that when rays come out of a drop of rain contiguous to one another, either after one or after two reflections, they must enter the drop nearly at one and the same place. And if such rays as are contiguous are parallel after the first reflection, they will emerge parallel, and therefore will be effectual. Let *zv* and *yw* be contiguous rays which come from the sun, and are parallel to one another when they fall upon the lower part of the drop, suppose these rays to be refracted at *v* and *w*, and to be reflected at *h* and *i*; if they are parallel to one another, as *h f*, *g i*, after this first reflection, then, after they are reflected a second time from *f* and *g*, and refracted a second time as they emerge at *d* and *b*, they will go out of the drop parallel to one another in the lines *dt* and *bo*, and will therefore be effectual.

The rays *zv*, *yw*, are refracted towards the perpendiculars *vl*, *wl*, when they enter the drop, and will be made to converge. As these rays are very oblique, their focus will not be far from the surface *vw*. If this focus is at *k*, the rays, after they have passed the focus, will diverge from thence in the directions *kh*, *ki*; and if *ki* is the principal focal distance of the concave reflecting surface *h i*, the reflected rays *h f*, *i g*, will be parallel. These rays *ef*, *ig*, are reflected again from the concave surface *fg*, and will meet in a focus at *e*, so that *g e* will be the principal focal distance of this reflecting surface *fg*. And because *h i* and *fg* are parts of the same sphere, the principal focal distances *ge* and *k i* will be equal to one another. When the rays have passed the focus *e*, they will diverge from thence in the lines *ed*, *eb*: and we are to show, that when they emerge at *d* and *b*, and are refracted there, they will become parallel.

Now if the rays *vk*, *wk*, when they have met at *k*, were to be turned back again in the directions *k v*, *k w*, and were to emerge at *v* and *w*, they would be refracted into the lines of their incidence, *vz*, *wy*, and therefore would be parallel. But since *ge* is equal to *ik*, as has already been shown, the rays *ed*, *eb*, that diverge from *e*, fall in the same manner upon the drop at *d* and *b*, as the rays *kv*, *kw*, would fall upon it at *v* and *w*; and *e d*, *e b*, are just as much inclined to the refracting surface *d b*, as *kv*, *kw*, would be to the surface *v w*. From hence it follows, that the rays *ed*, *eb*, emerging at *d* and *b*, will be refracted in the same manner, and will have the same direction in respect of one another, as *kv*, *kw*, would have. But *kv* and *kw* would be parallel after refraction. Therefore *ed* and *eb* will emerge in lines *dp*, *bo*, so as to be parallel to one another, and consequently so as to be effectual.

When

Of the Rainbow.

*When rays that are effectual emerge from a drop of rain after two reflections and two refractions, those which are most refrangible will at their emersion make a greater angle with the incident rays than those do which are least refrangible; and by this means the rays of different colours will be separated from one another.*

Plate CCCLX. If rays of different colours, which are differently refrangible, emerge at any point *b* (fig. 12.), these rays will not be all of them equally refracted from the perpendicular. Thus, if *b o* is a red ray, which is of all others the least refrangible, and *b m* is a violet ray, which is of all others the most refrangible; when these two rays emerge at *b*, the violet ray will be refracted more from the perpendicular *b x* than the red ray, and the refracted angle *x b m* will be greater than the refracted angle *x b o*. From hence it follows, that these two rays, after emersion, will diverge from one another. In like manner, the rays that emerge at *d* will diverge from one another; a red ray will emerge in the line *d p*, a violet ray in the line *d t*. So that though all the effectual red rays of the beam *b d m t* are parallel to one another, and all the effectual red rays of the beam *b d o p* are likewise parallel to one another, yet the violet rays will not be parallel to the red ones, but the violet beam will diverge from the red beam. Thus the rays of different colours will be separated from one another.

This will appear farther, if we consider what the proposition affirms, That any violet or most refrangible ray will make a greater angle with the incident rays, than any red or least refrangible ray makes with the same incident rays. Thus if *y w* is an incident ray, *b m* a violet ray emerging from the point *b*, and *b o* a red ray emerging from the same point; the angle which the violet ray makes with the incident one is *y r m*, and that which the red ray makes with it is *y s o*. Now *y r m* is a greater angle than *y s o*. For in the triangle *b r s* the internal angle *b r s* is less than *b s y* the external angle at the base. (Eucl. B. I. Prop. 16.) But *y r m* is the complement of *b r s* or of *b r y* to two right ones, and *y s o* is the complement of *b s y* to two right ones. Therefore, since *b r y* is less than *b s y*, the complement of *b r y* to two right angles will be greater than the complement of *b s y* to two right angles; or *y r m* will be greater than *y s o*.

Or otherwise: Both the rays *b o* and *b m*, when they are refracted in passing out of the drop at *b*, are turned round upon the point *b* from the perpendicular *b x*. Now either of these lines *b o* or *b m* might be turned round in this manner, till it made a right angle with *y w*. Consequently, that ray which is most turned round upon *b*, or which is most refracted, will make an angle with *y w*, that will be nearer to a right one than that ray makes with it which is least rurned round upon *b*, or which is least refracted. Therefore that ray which is most refracted will make a greater angle with the incident ray than that which is least refracted.

But since the emerging rays, as they are differently refrangible, make different angles with the same incident ray *y w*, the refraction which they suffer at emersion will separate them from one another.

The angle *y r m*, which the most refrangible or violet rays make with the incident ones, is found by calculation to be 54° 7′; and the angle *y s o*, which the least refrangible or red rays make with the incident ones, is found to be 50° 57′: the angles, which the rays of the intermediate colours, indigo, blue, green, yellow, and orange, make with the incident rays, are intermediate angles between 54° 7′ and 50° 57′.

*If a line is supposed to be drawn from the centre of the sun through the eye of the spectator; the angle which, after two refractions and two reflections, any effectual ray makes with the incident ray, will be equal to the angle which it makes with that line.*

If *y w* (fig. 12.) is an incident ray, *b o* an effectual ray, and *q n* a line drawn from the centre of the sun though *o* the eye of the spectator; the angle *y s o*, which the effectual ray makes with the incident ray, is equal to *s o n* the angle which the same effectual ray makes with the line *q n*. For *y w* and *q n*, considered as drawn from the centre of the sun, are parallel; *b o* crosses them, and consequently makes the alternate angles *y s o*, *s o n*, equal to one another. Eucl. B. I Prop. 29.

*When the sun shines upon the drops of rain as they are falling, the rays that come from these drops to the eye of a spectator, after two reflections and two refractions, produce the secondary rainbow.*

208 The secondary rainbow produced by two reflections and two refractions.

The secondary rainbow is the outermost, CHD, fig. 11. When the sun shines upon a drop of rain H; and the rays HO, which emerge at H so as to be effectual, make an angle HOP of 54° 7′ with LOP a line drawn from the sun through the eye of the spectator; the same effectual rays will make likewise an angle of 54° 7′ with the incident rays S, and the rays which emerge at this angle are violet ones, by what was observed above. Therefore, if the spectator's eye is at O, none but violet rays will enter it: for as all the other rays make a less angle with OP, they will fall above the spectator's eye. In like manner, if the effectual rays that emerge from the drop G make an angle of 50° 57′ with the line OP, they will likewise make the same angle with the incident rays S; and consequently, from the drop G to the spectator's eye at O, no rays will come but red ones; for all the other rays making a greater angle with the line OP, will fall below the eye at O. For the same reason, the rays emerging from the intermediate drops between H and G, and coming to the spectator's eye at O, will emerge at intermediate angles, and therefore will have the intermediate colours. Thus if there are seven drops from H to G inclusively, their colours will be violet, indigo, blue, green, yellow, orange, and red. This coloured line is the breadth of the secondary rainbow.

Now, if HOP was to turn round upon the line OP, like a pair of compasses upon one of the legs OP with the opening HOP, it is plain from the supposition, that, in such a revolution of the drop H, the angle HOP would be the same, and consequently the emerging rays would make the same angle with the incident ones. But in such a revolution the drop would describe a circle of which P would be the centre, and CNHRD an arc. Consequently, since, when the drop is at N, or at R, or anywhere else in that arc, the emerging rays make the same angle with the incident ones as when the drop is at H, the colour of the drop will

Of the Rainbow. will be the same to an eye placed at O, whether the drop is at N, or at H, or at R, or anywhere else in that arc. Now though the drop does not thus turn round as it falls, and does not pass through the several parts of this arc, yet, since there are drops of rain falling everywhere at the same time, when one drop is at H, there will be another at R, another at N, and others in all parts of the arc; and these drops will all of them be violet-coloured, for the same reason that the drop H would have been of this colour if it had been in any of those places. In like manner, as the drop G is red when it is at G, it would likewise be red in any part of the arc CWGQD; and so will any other drop when, as it is falling, it comes to any part of that arc. Thus as the sun shines upon the rain, whilst it falls, there will be two arcs produced, a violet-coloured one CNHRD, and a red one CWGQD; and for the same reasons the intermediate space between these two arcs will be filled up with arcs of the intermediate colours. All these arcs together make up the secondary rainbow.

*The colours of the secondary rainbow are fainter than those of the primary rainbow; and are ranged in the contrary order.*

209 Why the colours of the secondary rainbow are fainter than those of the primary, and ranged in a contrary order.

The primary rainbow is produced by such rays as have been only once reflected; the secondary rainbow is produced by such rays as have been twice reflected. But at every reflection some rays pass out of the drop of rain without being reflected; so that the oftener the rays are reflected, the fewer of them are left. Therefore the colours of the secondary bow are produced by fewer rays, and consequently will be fainter, than the colours of the primary bow.

In the primary bow, reckoning from the outside of it, the colours are ranged in this order; red, orange, yellow, green, blue, indigo, violet. In the secondary bow, reckoning from the outside, the colours are violet, indigo, blue, green, yellow, orange, red. So that the the red, which is the outermost or highest colour in the primary bow, is the innermost or lowest colour in the secondary one.

Now the violet rays, when they emerge so as to be effectual after one reflection, make a less angle with the incident rays than the red ones; consequently the violet rays make a less angle with the lines OP (fig. 11.) than the red ones. But, in the primary rainbow, the rays are only once reflected, and the angle which the effectual rays make with OP is the distance of the coloured drop from P the centre of the bow. Therefore the violet drops, or violet arc, in the primary bow, will be nearer to the centre of the bow than the red drops or red arc; that is, the innermost colour in the primary bow will be violet, and the outermost colour will be red. And, for the same reason, through the whole primary bow, every colour will be nearer to the centre P, as the rays of that colour are more refrangible.

Plate CCCLX.

But the violet rays, when they emerge so as to be effectual after two reflections, make a greater angle with the incident rays than the red ones; consequently the violet rays will make a greater angle with the line OP, than the red ones. But in the secondary rainbow the rays are twice reflected, and the angle which effectual rays make with OP is the distance of the coloured drop from P the centre of the bow. Therefore the violet drops or violet arc in the secondary bow will be farther from the centre of the bow, than the red drops or red arc; that is, the outermost colour in the secondary bow will be violet, and the innermost colour will be red. And, for the same reason, through the whole secondary bow, every colour will be further from the centre P, as the rays of that colour are more refrangible.

The apparent place &c. of objects.

### § 2. *Of Coronas, Parhelia, &c.*

Under the articles CORONA and PARHELION, a pretty full account is given of the different hypotheses concerning these phenomena, and likewise of the method by which these hypotheses are supported, from the known laws of refraction and reflection; to which therefore, in order to avoid repetition, we must refer.

### § 3. *Of the apparent Place, Distance, Magnitude, and Motion of Objects.*

Philosophers in general had taken for granted, that the place to which the eye refers any visible object seen by reflection or refraction, is that in which the visual ray meets a perpendicular from the object upon the reflecting or refracting plane. But this method of judging of the place of objects was called in question by Dr Barrow, who contended that the arguments brought in favour of the opinion were not conclusive. These arguments are, that the images of objects appear straight in a plane mirror, but curved in a convex or concave one: that a straight thread, when partly immersed perpendicularly in water, does not appear crooked as when it is obliquely plunged into the fluid; but that which is within the water seems to be a continuation of that which is without. With respect to the reflected image, however, of a perpendicular right line from a convex or concave mirror, he says, that it is not easy for the eye to distinguish the curve that it really makes; and that, if the appearance of a perpendicular thread, part of which is plunged in water, be closely attended to, it will not favour the common hypothesis. If the thread is of any shining metal, as silver, and viewed obliquely, the image of the part immersed will appear to detach itself sensibly from that part which is without the water, so that it cannot be true that every object appears to be in the same place where the refracted ray meets the perpendicular; and the same observation, he thinks, may be extended to the case of reflection. According to this writer, we refer every point of an object to the place from which the pencils of light, that give us the image of it, issue, or from which they would have issued if no reflecting or refracting substance intervened. Pursuing this principle, he proceeds to investigate the place in which the rays issuing from each of the points of an object, and which reach the eye after one reflection or refraction, meet; and he found, that the refracting surface was plane, and the refraction was made from a denser medium into a rarer, those rays would always meet in a place between the eye and a perpendicular to the point of incidence. If a convex miror be used, the case will be the same; but if the mirror be plane, the rays will meet in the perpendicular, and beyond it if it be con-

210 Dr Barrow's theory respecting the apparent place of objects.

cave.

The apparent place, &c. of objects.

cave. He also determined, according to these principles, what form the image of a right line will take, when it is presented in different manners to a spherical mirror, or when it is seen through a refracting medium.

Probable as Dr Barrow thought the maxim which he endeavoured to establish, concerning the supposed place of visible objects, he has the candour to mention an objection to it, and to acknowledge that he was not able to give a satisfactory solution of it. It is this. Let an object be placed beyond the focus of a convex lens; and if the eye be close to the lens, it will appear confused, but very near to is true place. If the eye be a little withdrawn, the confusion will increase, and the object will seem to come nearer; and when the eye is near the focus, the confusion will be exceedingly great, and the object will seem to be close to the eye. But in this experiment the eye receives no rays but those that are converging: and the point from which they issue is so far from being nearer than the object, that it is beyond it; notwithstanding which, the object is conceived to be much nearer than it is, though no very distinct idea can be formed of its precise distance. It may be observed, that in reality, the rays falling upon the eye in this case in a manner quite different from that in which they fall upon it in other circumstances, we can form no judgment about the place from which they issue. This subject was afterwards taken up by Berkeley, Smith, Montucla, and others.

211 M. de la Hire's observations

M. de la Hire made several valuable observations concerning the distance of visible objects, and various other phenomena of vision, which are well worth our notice. He also took particular pains to ascertain the manner in which the eye conforms itself to the view of objects placed at different distances. He enumerates five circumstances, which assist us in judging of the distance of objects, namely their apparent magnitude, the strength of the colouring, the direction of the two eyes, the parallax of the objects, and the distinctness of their small parts. Painters, he says, can only take advantage of the two first-mentioned circumstances, and therefore pictures can never perfectly deceive the eye; but in the decorations of theatres, they, in some measure, make use of them all. The size of objects, and the strength of their colouring, are diminished in proportion to the distance at which they are intended to appear. Parts of the same object which are to appear at different distances, as columns in an order of architecture, are drawn upon different planes, a little removed from one another, that the two eyes may be obliged to change their direction, in order to distinguish the parts of the nearer plane from those of the more remote. The small distance of the planes serves to make a small parallax, by changing the position of the eye; and as we do not preserve a distinct idea of the quantity of parallax, corresponding to the different distances of objects, it is sufficient that we perceive there is a parallax, to be convinced that these planes are distant from one another, without determining what that distance is; and as to the last circumstance, viz. the distinctness of the small parts of objects, it is of no use in discovering the deception, on account of the false light that is thrown upon these decorations.

To these observations concerning deceptions of sight, we shall add a similar one of M. le Cat, who took notice that the reason why we imagine objects to be larger when they are seen through a mist, is the dimness or obscurity with which they are then seen; this circumstance being associated with the idea of great distance. This, he says, is confirmed by our being surprised to find, upon approaching such objects, that they are so much nearer to us, as well as so much smaller, than we had imagined.

The apparent place, &c. of objects.

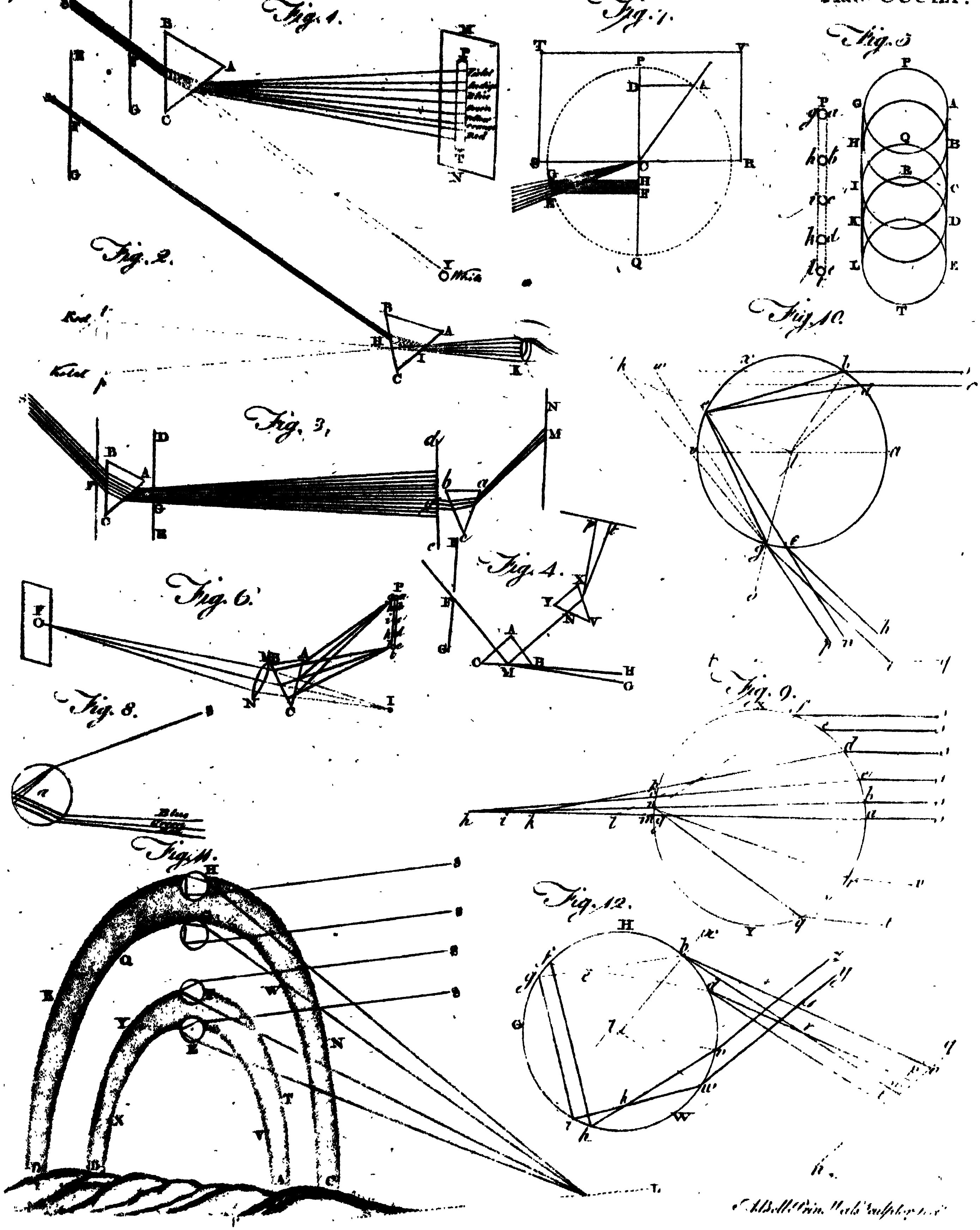
212 M. le Cat's account of the largeness of objects in mist.

Among other cases concerning vision, which fell under the consideration of M. de la Hire, he mentions one which is of difficult solution. It is when a candle, in a dark place, and situated beyond the limits of distinct vision, is viewed through a very narrow chink in a card; in which case a considerable number of candles, sometimes so many as six, will be seen along the chink. This appearance he ascribes to small irregularities in the surface of the humours of the eye, the effect of which is not sensible when rays are admitted into the eye through the whole extent of the pupil, and consequently one principal image effaces a number of small ones; whereas, in this case, each of them is formed separately, and no one of them is so considerable as to prevent the others from being perceived at the same time.

There are few persons, M. de la Hire observes, who have both their eyes perfectly equal, not only with respect to the limits of distinct vision, but also with respect to the colour with which objects appear tinged when they are viewed by them, especially if one of the eyes has been exposed to the impression of a strong light. To compare them together in this respect, he directs us to take two thin cards, and to make in each of them a round hole of a third or a fourth of a line in diameter, and, applying one of them to each of the eyes, to look through the holes on a white paper, equally illuminated, when a circle of the paper will appear to each of the eyes, and, placing the cards properly, these two circles may be made to touch one another, and thereby the appearance of the same object to each of the eyes may be compared to the greatest advantage. To make this experiment with the greatest exactness, it is necessary, he says, that the eyes be kept shut some time before the cards be applied to them.

M. de la Hire first endeavoured to explain the cause of those dark spots which seem to float before the eyes, especially those of old people. They are most visible when the eyes are turned towards an uniform white object, as the snow in the open fields. If they be fixed when the eye is so, this philosopher supposed that they were occasioned by extravasated blood upon the retina. But he thought that the moveable spots were occasioned by opaque matter floating in the aqueous humour of the eye. He thought the vitreous humour was not sufficiently limpid for this purpose.

By the following calculation, M. de la Hire gives us an idea of the extreme sensibility of the optic nerves. One may see very easily, at the distance of 4000 toises, the sail of a wind mill, 6 feet in diameter; and the eye being supposed to be an inch in diameter, the picture of this sail, at the bottom of the eye, will be $\frac{1}{8000}$ of an inch, which is less than the 666th part of a line, and is about the 66th part of a common hair, or the 8th part of a single thread of silk. So small, therefore, must one of the fibres of the optic nerve be, which he says




A.Bell Prim. Wal. Sculptor fecit.

Apparent place, &c. of objects.

says is almost inconceivable, since each of these fibres is a tube that contains spirits. If birds perceive distant objects as well as men, which he thinks very probable, he observes that the fibres of their optic nerves must be much finer than ours.

213 Berkeley's account of the judgement formed concerning distance by confused vision.

The person who first took much notice of Dr Barrow's hypothesis was the ingenious Dr Berkeley, bishop of Cloyne, who distinguished himself so much by the objections which he started to the reality of a material world, and by his opposition to the Newtonian doctrine of fluxions. In his Essay towards a new Theory of Vision, he observes, that the circle formed upon the retina, by the rays which do not come to a focus, produce the same confusion in the eye, whether they cross one another before they reach the retina, or tend to do it afterwards: and therefore that the judgment concerning distance will be the same in both the cases, without any regard to the place from which the rays originally issued; so that in this case, as, by receding from the lens, the confusion, which always accompanies the nearness of an object, increases, the mind will judge that the object comes nearer.

214 Smith's account.

But, says Dr Smith, if this be true, the object ought always to appear at a less distance from the eye than that at which objects are seen distinctly, which is not the case: and to explain this appearance, as well as every other in which a judgment is formed concerning distance, he maintains, that we judge of it by the apparent magnitude of objects only, or chiefly; so that, since the image grows larger as we recede from the lens through which it is viewed, we conceive the object to come nearer. He also endeavours to show, that, in all cases in which glasses are used, we judge of distance by the same simple rule; from which he concludes universally, that the apparent distance of an object seen in a glass is to its apparent distance seen by the naked eye, as the apparent magnitude to the naked eye is to its apparent magnitude in the glass.

But that we do not judge of distance merely by the angle under which objects are seen, is an observation as old as Alhazen, who mentions several instances, in which, though the angles under which objects appear to be different, the magnitudes are universally and instantaneously deemed not to be so. And Mr Robins clearly shows the hypothesis of Dr Smith to be contrary to fact in the most common and simple cases.

215 Objected to by Mr Robins.

In microscopes, he says, it is impossible that the eye should judge the object to be nearer than the distance at which it has viewed the object itself, in proportion to the degree of magnifying. For when the microscope magnifies much, this rule would place the image at a distance, of which the sight cannot possibly form any opinion, as being an interval from the eye at which no object can be seen. In general, he says, he believes, that whoever looks at an object through a convex glass, and then at the object itself without the glass, will find it to appear nearer in the latter case, though it be magnified in the glass; and in the same trial with the concave glass, though by the glass the object be diminished, it will appear nearer through the glass than without it.

But the most convincing proof that the apparent distance of the image is not determined by its apparent magnitude, is the following experiment. If a double convex glass be held upright before some luminous object, as a candle, there will be seen two images, one erect, and the other inverted. The first is made simply by reflection from the nearest surface, the second by reflection from the farther surface, the rays undergoing a refraction from the first surface both before and after the reflection. If this glass has not too short a focal distance when it is held near the object, the inverted image will appear larger than the other, and also nearer; but if the glass be carried off from the object, though the eye remain as near to it as before, the inverted image will diminish so much faster than the other, that, at length, it will appear very much less than it, but still nearer. Here, says Mr Robins, two images of the same subject are seen under one view, and their apparent distances immediately compared; and here it is evident, that those distances have no necessary connexion with the apparent magnitude. He also shows how this experiment may be made still more convincing, by sticking a piece of paper on the middle of the lens, and viewing it through a short tube.

216 M. Bouguer adopts Dr Barrow's maxim.

M. Bouguer adopts the general maxim of Dr Barrow, in supposing that we refer objects to the place from which the pencils of rays seemingly converge at their entrance into the pupil. But when rays issue from below the surface of a vessel of water, or any other refracting medium, he finds that there are always two different places of this seeming convergence; one of them of the rays that issue from it in the same vertical circle, and therefore fall with different degrees of obliquity upon the surface of the refracting medium; and another, of those that fall upon the surface with the same degree of obliquity, entering the eye laterally with respect to one another. Sometimes, he says, one of these images is attended to by the mind, and sometimes the other, and different images may be observed by different persons. An object plunged in water affords an example, he says, of this duplicity of images.

Plate CCCLXI.

If BA $b$ (fig. 1.) be part of the surface of water, and the object be at O, there will be two images of it in two different places; one at G, on the caustic by refraction, and the other at E, in the perpendicular AO, which is as much a caustic as the other line. The former image is visible by the rays ODM, O $d$ $m$, which are one higher than the other, in their progress to the eye; whereas the image at E is made by the rays ODM, O $r$ $f$, which enter the eye laterally. This, says he, may serve to explain the difficulty of Father Tacquet, Barrow, Smith, and many other authors, and which Newton himself considered as a very difficult problem, though it might not be absolutely insoluble.

G. W. Kraft has ably supported the opinion of Dr Barrow, that the place of any point, seen by reflection from the surface of any medium, is that in which rays issuing from it, infinitely near to one another, would meet; and considering the case of a distant object, viewed in a concave mirror, by an eye very near to it, when the image, according to Euclid and other writers would be between the eye and the object, and the rule of Dr Barrow cannot be applied; he says that in this case the speculum may be considered as a plane, the effect being the same, only the image is more obscure.

Apparent place, &c. of objects.

Dr Porterfield gives a distinct and comprehensive view of the natural methods of judging concerning the distance of objects.

217 Dr Porterfield's view of the subject.

The conformation of the eye, he observes, can be of no use to us with respect to objects that are placed without the limits of distinct vision. As the object, however, does then appear more or less confused, according as it is more or less removed from those limits, this confusion assists the mind in judging of the distance of the object; it being always esteemed so much the nearer, or the farther off, by how much the confusion is greater. But this confusion hath its limits also beyond which it can never extend; for when an object is placed at a certain distance from the eye, to which the breadth of the pupil bears no sensible proportion, the rays of light that come from a point in the object, and pass the pupil, are so little diverging, that they may be considered as parallel. For a picture on the retina will not be sensibly more confused, though the object be removed to a much greater distance.

The most universal, and frequently the most sure means of judging of the distance of objects is, he says, the angle made by the optic axis. For our two eyes are like two different stations, by the assistance of which distances are taken; and this is the reason why those persons who are blind of one eye, so frequently miss their marks in pouring liquor into a glass, snuffing a candle, and such other actions as require that the distance be exactly distinguished. To convince ourselves of the usefulness of this method of judging of the distance of objects, he directs us to suspend a ring in a thread, so that its side may be towards us, and the hole in it to the right and left hand; and taking a small rod, crooked at the end, retire from the ring two or three paces, and having with one hand covered one of our eyes, to endeavour with the other to pass the crooked end of the rod through the ring. This, says he, appears very easy; and yet, upon trial, perhaps once in 100 times we shall not succeed, especially if we move the rod a little quickly.

Our author observes, that by persons recollecting the time when they began to be subject to the mistakes above-mentioned, they may tell when it was that they lost the use of one of their eyes; which many persons are long ignorant of, and which may be a circumstance of some consequence to a physician †. The use of this second method of judging of distances Dechales limited to 120 feet; beyond which, he says, we are not sensible of any difference in the angle of the optic axis.

† See *Medicine*, N° 360.

A third method of judging of the distance of objects, consists in their apparent magnitudes, on which so much stress was laid by Dr Smith. From this change in the magnitude of the image upon the retina, we easily judge of the distance of objects, as often as we are otherwise acquainted with the magnitude of the objects themselves; but as often as we are ignorant of the real magnitude of bodies, we can never, from their apparent magnitude, form any judgment of their distance.

From this we may see why we are so frequently deceived in our estimates of distance, by any extraordinary magnitudes of objects seen at the end of it; as, in travelling towards a large city, or a castle, or a cathedral church, or a mountain larger than ordinary, we fancy them to be nearer than we find them to be. This also is the reason why animals, and all small objects, seen in valleys, contiguous to large mountains, appear exceedingly small. For we think the mountain nearer to us than if it were smaller; and we should not be surprised at the smallness of the neighbouring animals, if we thought them farther off. For the same reason, we think them exceedingly small, when they are placed upon the top of a mountain, or a large building; which appear nearer to us than they really are, on account of their extraordinary size.

218 Why objects seen from a high building appear smaller than they are.

Dr Jurin clearly accounts for our imagining objects, when seen from a high building, to be smaller than they are, and smaller than we fancy them to be when we view them at the same distance on level ground. It is, says he, because we have no distinct idea of distance in that direction, and therefore judge of things by their pictures upon the eye only; but custom will enable us to judge rightly even in this case.

Let a boy, says he, who has never been upon any high building, go to the top of the monument, and look down into the street; the objects seen there, as men and horses, will appear so small as greatly to surprise him. But 10 or 20 years after, if in the mean time he has used himself now and then to look down from that and other great heights, he will no longer find the same objects to appear so small. And if he was to view the same objects from such heights as frequently as he sees them upon the same level with himself in the streets, he supposes that they would appear to him just of the same magnitude from the top of the monument, as they do from a window one story high. For this reason it is, that statues placed upon very high buildings ought to be made of a larger size than those which are seen at a nearer distance; because all persons, except architects, are apt to imagine the height of such buildings to be much less than it really is.

The fourth method by which Dr Porterfield says that we judge of the distance of objects, is the force with which their colour strikes upon our eyes. For if we be assured that two objects are of a similar and like colour, and that one appears more bright and lively than the other, we judge that the brighter object is the nearer of the two.

The fifth method consists in the different appearance of the small parts of objects. When these parts appear distinct, we judge that the object is near; but when they appear confused, or when they do not appear at all, we judge that it is at a greater distance. For the image of any object, or part of an object, diminishes as the distance of it increases.

The sixth and last method by which we judge of the distance of objects is, that the eye does not represent to our mind one object alone, but at the same time all those that are placed betwixt us and the principal object, whose distance we are considering; and the more this distance is divided into separate and distinct parts, the greater it appears to be. For this reason, distances upon uneven surfaces appear less than upon a plane: for the inequalities of the surfaces, such as hills, and holes, and rivers, that lie low and out of sight, either do not appear, or hinder the parts that lie behind them from appearing; and so the whole apparent distance is diminished by the parts that do not

Apparent place, &c. of objects.

not appear in it. This is the reason that the banks of a river appear contiguous to a distant eye, when the river is low and not seen.

219
Several fallacies of vision explained.

Dr Porterfield very well explains several fallacies in vision depending upon our mistaking the distances of objects. Of this kind, he says, is the appearance of parallel lines, and long vistas consisting of parallel rows of trees; for they seem to converge more and more as they are farther extended from the eye. The reason of this, he says, is because the apparent magnitudes of their perpendicular intervals are perpetually diminishing, while, at the same time, we mistake their distance. Hence we may see why, when two parallel rows of trees stand upon an ascent, whereby the more remote parts appear farther off than they really are, because the line that measures the length of the vistas now appears under a greater angle than when it was horizontal, the trees, in such a case, will seem to converge less, and sometimes, instead of converging, they will be thought to diverge.

For the same reason that a long vista appears to converge more and more the farther it is extended from the eye, the remoter parts of a horizontal walk or a long floor will appear to ascend gradually; and objects placed upon it, the more remote they are the higher they will appear, till the last be seen on a level with the eye; whereas the ceiling of a long gallery appears to descend towards a horizontal line, drawn from the eye of the spectator. For this reason, also, the surface of the sea, seen from an eminence, seems to rise higher and higher the farther we look; and the upper parts of high buildings seem to stoop, or incline forwards over the eye below, because they seem to approach towards a vertical line proceeding from the spectator's eye; so that statues on the top of such buildings, in order to appear upright, must recline, or bend backwards.

Our author also shows the reason why a windmill, seen from a great distance, is sometimes imagined to move the contrary way from what it really does, by our taking the nearer end of the sail for the more remote. The uncertainty we sometimes find in the course of the motion of a branch of lighted candles, turned round at a distance, is owing, he says, to the same cause; as also our sometimes mistaking a convex for a concave surface, more especially in viewing seals and impressions with a convex glass or a double microscope; and lastly, that, upon coming in a dark night into a street, in which there is but one row of lamps, we often mistake the side of the street they are on.

Far more light was thrown upon this curious subject by M. Bouguer.

220
Great light thrown upon this subject by M. Bouguer.

The proper method of drawing the appearance of two rows of trees that shall appear parallel to the eye, is a problem which has exercised the ingenuity of several philosophers and mathematicians. That the apparent magnitude of objects decreases with the angle under which they are seen, has always been acknowledged. It is also acknowledged, that it is only by custom and experience that we learn to form a judgement both of magnitudes and distances. But in the application of these maxims to the above mentioned problem, all persons, before M. Bouguer, made use of the real distance instead of the apparent one; by which only the mind can form its judgment. And it is manifest, that, if any circumstances contribute to make the distance appear otherwise than it is in reality, the apparent magnitude of the object will be affected by it; for the same reason, that, if the magnitude be misapprehended, the idea of the distance will vary.

For want of attending to this distinction, Tacquet pretended to demonstrate, that nothing can give the idea of two parallel lines (rows of trees for instance) to an eye situated at one of their extremities, but two hyperbolical curves, turned the contrary way; and M. Varignon maintained, that in order to make a vista appear of the same width, it must be made narrower, instead of wider, as it recedes from the eye.

M. Bouguer observes, that very great distances, and those that are considerably less than they, make nearly the same impression upon the eye. We, therefore, always imagine great distances to be less than they are; and for this reason the ground plan of a long vista always appears to rise. The visual rays come in a determinate direction; but as we imagine that they terminate sooner than they do, we necessarily conceive that the place from which they issue is elevated. Every large plane, therefore, as AB, (fig. 2.) viewed by an eye at O, will seem to lie in such a direction as A*b*; and consequently lines, in order to appear truly parallel on the plane AB, must be drawn so as that they would appear parallel on the plane A*d*, and be from thence projected to the plane AB. Plate CCCLXI.

To determine the inclination of the apparent ground-plan A*d* to the true ground-plan AB, our ingenious author directs us to draw upon a piece of level ground two straight lines of a sufficient length (for which purpose lines fastened to small sticks are very convenient), making an angle of 3 or 4 degrees with one another. Then a person, placing himself within the angle, with his back towards the angular point, must walk backwards and forwards till he can fancy the lines to be parallel. In this situation, a line drawn from the point of the angle through the place of his eye, will contain the same angle with the true ground-plan which this does with the apparent one.

M. Bouguer then shows other more geometrical methods of determining this inclination; and says; that by these means he has often found it to be 4 or 5 degrees, though sometimes only 2 or 2½ degrees. The determination of this angle, he observes, is variable; depending upon the manner in which the ground is illuminated and the intensity of the light. The colour of the soil is also not without its influence, as well as the particular conformation of the eye, by which it is more or less affected by the same degree of light, and also the part of the eye on which the object is painted. When, by a slight motion of his head, he contrived, that certain parts of the soil, the image of which fell towards the bottom of his eye, should fall towards the top of the retina, he always thought that this apparent inclination became a little greater.

But what is very remarkable, and what he says he can assure his reader may be depended upon, is, that if he look towards a rising ground, the difference between the apparent ground-plan and the true one will be much more considerable, so that they will sometimes make an angle of 25 or 30 degrees. Of this he

Apparent place, &c. of objects.

had made frequent obfervations. Mountains, he fays, begin to be inacceffible when their fides make an angle from 35 to 37 degrees with the horizon, as then it is not poffible to climb them but by means of ftones or fhrubs, to ferve as fteps to fix the feet on. In thefe cafes, both he and his companions always agreed that the apparent inclination of the fide of the mountain was 60 or 70 degrees.

Plate CCCLXI

Thefe deceptions are reprefented in fig. 3. in which, when the ground-plan AM, or AN, is much inclined, the apparent ground-plan A*m*, or A*n*, makes a very large angle with it. On the contrary, if the ground dips below the level, the inclination of the apparent to the true ground-plan diminifhes, till, at a certain degree of the flope, it becomes nothing at all; the two plans AP and A*p* being the fame, fo that parallel lines drawn upon them would always appear fo. If the inclination below the horizon is carried beyond the fituation AP, the error will increafe; and what is very remarkable, it will be on the contrary fide; the apparent plan A*r* being always below the true plan AR, fo that if a perfon would draw upon the plan AR lines that fhall appear parallel to the eye, they muft be drawn converging, and not diverging, as is ufual on the level ground; becaufe they muft be the projections of two lines imagined to be parallel, on the plan A*r*, which is more inclined to the horizon than AR.

Thefe remarks, he obferves, are applicable to different planes expofed to the eye at the fame time. For if BH, fig. 4. be the front of a building, at the diftance of AB from the eye, it will be reduced in appearance to the diftance A*b*; and the front of the building will be *lb*, rather inclined towards the fpectator, unlefs the diftance be inconfiderable.

After making a great number of obfervations upon this fubject, our author concludes, that when a man ftands upon a level plane, it does not feem to rife fenfibly but at fome diftance from him. The apparent plane, therefore, has a curvature in it, at that diftance, the form of which is not very eafy to determine; fo that a man ftanding upon a level plane, of infinite extent, will imagine that he ftands in the centre of a bafon. This is alfo, in fome meafure, the cafe with a perfon ftanding upon the level of the fea.

He concludes with obferving, that there is no difficulty in drawing lines according to thefe rules, fo as to have any given effect upon the eye, except when fome parts of the profpect are very near the fpectator, and others very diftant from him, becaufe, in this cafe, regard muft be had to the conical or conoidal figure of a furface. A right line paffing at a fmall diftance from the obferver, and below the level of his eye, in that cafe almoft always appears fenfibly curved at a certain diftance from the eye; and almoft all figures in this cafe are fubject to fome complicated optical alteration to which the rules of perfpective have not as yet been extended. If a circle be drawn near our feet, and within that part of the ground which appears level to us, it will always appear to be a circle, and at a very confiderable diftance it will appear an ellipfe; but between thefe two fituations, it will not appear to be either the one or the other, but will be like one of thofe ovals of Defcartes, which is more curved on one of its fides than the other.

On thefe principles a parterre, which appears diftorted when it is feen in a low fituation, appears perfectly regular when it is viewed from a balcony or any other eminence. Still, however, the apparent irregularity takes place at a greater diftance, while the part that is near the fpectator is exempt from it. If AB, fig. 5. be the ground-plan, and A*a* be a perpendicular, under the eye, the higher it is fituated, at O, to the greater diftance will T, the place at which the plane begins to have an apparent afcent along T*b*, be removed.

All the varieties that can occur with refpect to the vifible motion of objects, are thus fuccinctly fummed up by Dr Porterfield under eleven heads.

1. An object moving very fwiftly is not feen, unlefs it be very luminous. Thus a cannon ball is not feen if it is viewed tranfverfely: but if it be viewed according to the line it defcribes, it may be feen, becaufe its picture continues long on the fame place of the retina; which, therefore, receives a more fenfible impreffion from the object.

2. A live coal fwung brifkly round in a circle appears a continued circle of fire, becaufe the impreffions made on the retina by light, being of a vibrating, and confequently of a lafting nature, do not prefently perifh, but continue till the coal performs its whole circuit, and returns again to its former place.

3. If two objects, unequally diftant from the eye, move with equal velocity, the more remote one will appear the flower; or, if their celerities be proportional to their diftances, they will appear equally fwift.

4. If two objects, unequally diftant from the eye, move with unequal velocities in the fame direction, their apparent velocities are in a ratio compounded of the direct ratio of their true velocities, and the reciprocal one of their diftances from the eye.

5. A vifible object moving with any velocity appears to be at reft, if the fpace defcribed in the interval of one fecond be imperceptible at the diftance of the eye. Hence it is that a near object moving very flowly, as the index of a clock, or a remote one very fwiftly, as a planet, feems to be at reft.

6. An object moving with any degree of velocity will appear at reft, if the fpace it runs over in a fecond of time be to its diftance from the eye as 1 to 1400.

7. The eye proceeding ftraight from one place to another, a lateral object, not too far off, whether on the right or left, will feem to move the contrary way.

8. The eye proceeding ftraight from one place to another, and being fenfible of its motion, diftant objects will feem to move the fame way, and with the fame velocity. Thus, to a perfon running eaftwards, the moon on his right hand appears to move the fame way, and with equal fwiftnefs; for, by reafon of its diftance, its image continues fixed upon the fame place of the retina, from whence we imagine that the object moves along with the eye.

9. If the eye and the object move both the fame way, only the eye much fwifter than the object, the laft will appear to go backwards.

10. If two or more objects move with the fame velocity, and a third remain at reft, the moveable ones will appear fixed, and the quiefcent in motion the contrary

Apparent place, &c. of objects.

contrary way. Thus clouds moving very swiftly, their parts seem to preserve their situation, and the moon to move the contrary way.

11. If the eye be moved with great velocity, lateral objects at rest appear to move the contrary way. Thus to a person sitting in a coach, and riding briskly through a wood, the trees seem to retire the contrary way; and to people in a ship, &c. the shores seem to recede.

221 Dr Porterfield's account of objects appearing to move to a giddy person when he and they are both at rest.

At the conclusion of these observations, our author endeavours to explain another phenomenon of motion, which, though very common and well known, had not, so far as he knew, been explained in a satisfactory manner. It is this: If a person turns swiftly round, without changing his place, all objects about will seem to move round in a circle the contrary way; and this deception continues not only while the person himself moves round, but, which is more surprising, it also continues for some time after he ceases to move, when the eye, as well as the object, is at absolute rest.

The reason why objects appear to move round the contrary way, when the eye turns round, is not so difficult to explain: for though, properly speaking, motion is not seen, as not being in itself the immediate object of sight; yet by the sight we easily know when the image changes its place on the retina, and thence conclude that either the object, the eye, or both, are moved. But by the sight alone we can never determine how far this motion belongs to the object, how far to the eye, or how far to both. If we imagine the eye at rest, we ascribe the whole motion to the object, though it be truly at rest. If we imagine the object at rest, we ascribe the whole motion to the eye, though it belongs entirely to the object; and when the eye is in motion, though we are sensible of its motion, yet, if we do not imagine that it moves so swiftly as it really does, we ascribe only a part of the motion to the eye, and the rest of it we ascribe to the object, though it be truly at rest. This last, he says, is what happens in the present case, when the eye turns round; for though we are sensible of the motion of the eye, yet we do not apprehend that it moves so fast as it really does; and therefore the bodies about appear to move the contrary way, as is agreeable to experience.

But the great difficulty still remains, viz. Why, after the eye ceases to move, objects should, for some time, still appear to continue in motion, though their pictures on the retina be truly at rest, and do not at all change their place. This, he imagined, proceeds from a mistake we are in with respect to the eye, which, though it be absolutely at rest, we nevertheless conceive as moving the contrary way to that in which it moved before; from which mistake, with respect to the motion of the eye, the objects at rest will appear to move the same way which the eye is imagined to move; and, consequently, will seem to continue their motion for some time after the eye is at rest.

222 Dr Wells accounts for this phenomenon.

This is ingenious, but perhaps not just. An account of this matter, which seems to us more satisfactory, has been lately given to the public by Dr Wells. "Some of the older writers upon optics (says this able philosopher) imagined the visive spirits to be contained in the head, as water is in a vessel; which, therefore, when once put in motion by the rotation of our bodies, must continue in it for some time after this has ceased; and to this real circular movement of the visive spirits, while the body is at rest, they attributed the apparent motions of objects in giddiness. Dechales saw the weakness of this hypothesis; and conjectured, that the phenomenon might be owing to a real movement of the eyes; but produced no fact in proof of his opinion. Dr Porterfield, on the contrary, supposed the difficulty of explaining it to consist in showing, why objects at rest appear in motion to an eye which is also at rest. The solution he offered of this representation of the phenomenon, is not only extremely ingenious, but is I believe the only probable one which can be given. It does not apply, however, to the fact which truly exists; for I shall immediately show, that the eye is not at rest, as he imagined. The last author I know of who has touched upon this subject is Dr Darwin. His words are, 'When any one turns round rapidly on one foot till he becomes dizzy, and falls upon the ground, the spectra of the ambient objects continue to present themselves in rotation, or appear to librate, and he seems to behold them for some time in motion.' I do not indeed pretend to understand his opinion fully; but this much seems clear, that if such an apparent motion of the surrounding objects depends in any way upon their spectra, or the illusive representations of those objects, occasioned by their former impressions upon the retinas, no similar motion would be observed, were we to turn ourselves round with our eyes shut, and not to open them till we became giddy; for in this case, as the surrounding objects could not send their pictures to the retinas, there would consequently be no spectra to present themselves afterward in rotation. But whoever will make the experiment, will find, that objects about him appear to be equally in motion, when he has become giddy by turning himself round, whether this has been done with his eyes open or shut. I shall now venture to propose my own opinion upon this subject.

223 Upon what data we judge visible objects to be in motion or at rest.

"If the eye be at rest, we judge an object to be in motion when its picture falls in succeeding times upon different parts of the retina; and if the eye be in motion, we judge an object to be at rest, as long as the change in the place of its picture upon the retina holds a certain correspondence with the change of the eye's position. Let us now suppose the eye to be in motion, while, from some disorder in the system of sensation, we are either without those feelings which indicate the various positions of the eye, or are not able to attend to them. It is evident, that in such a state of things an object at rest must appear to be in motion, since it sends in succeeding times its picture to different parts of the retina. And this seems to be what happens in giddiness. I was first led to think so from observing, that, during a slight fit of giddiness I was accidentally seized with, a coloured spot, occasioned by looking steadily at a luminous body, and upon which I happened at that moment to be making an experiment, was moved in a manner altogether independent of the positions I conceived my eyes to possess. To determine this point, I again produced the spot, by looking some time at the flame of a candle: then turning myself round till I became giddy, I suddenly discontinued this motion, and directed my eyes

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to the middle of a sheet of paper, fixed upon the wall of my chamber. The spot now appeared upon the paper, but only for a moment; for it immediately after seemed to move to one side, and the paper to the other, notwithstanding I conceived the position of my eyes to be in the mean while unchanged. To go on with the experiment, when the paper and spot had proceeded to a certain distance from each other, they suddenly came together again; and this separation and conjunction were alternately repeated a number of times, the limits of the separation gradually becoming less, till at length the paper and spot both appeared to be at rest, and the latter to be projected upon the middle of the former. I found also, upon repeating and varying the experiment a little, that when I had turned myself from left to right, the paper moved from right to left, and the spot consequently the contrary way; but that when I had turned from right to left, the paper would then move from left to right. These were the appearances observed while I stood erect. When I inclined, however, my head in such a manner as to bring the side of my face parallel to the horizon, the spot and paper would then move from each other, one upward and the other downward. But all these phenomena demonstrate, that there was a real motion in my eyes at the time I imagined them to be at rest; for the apparent situation of the spot, with respect to the paper, could not possibly have been altered, without a real change of the position of those organs. To have the same thing proved in another way, I desired a person to turn quickly round, till he became very giddy; then to stop himself, and look stedfastly at me. He did so, and I could plainly see, that although he thought his eyes were fixed, they were in reality moving in their sockets, first toward one side and then toward the other."

224 Curious experiments to ascertain this.

225 A remarkable deception explained by M. le Cat. Plate CCCLXI.

M. Le Cat well explains a remarkable deception, by which a person shall imagine an object to be on the opposite side of a board, when it is not so, and also inverted and magnified. It is illustrated by fig. 6. in which D represents the eye, and CB a large black board, pierced with a small hole. E is a large white board, placed beyond it, and strongly illuminated; and *d* a pin, or other small object, held betwixt the eye and the first board. In these circumstances, the pin shall be imagined to be at F, on the other side of the board, where it will appear inverted and magnified; because what is in fact perceived, is the shadow of the pin upon the retina; and the light that is stopped by the upper part of the pin coming from the lower part of the enlightened board, and that which is stopped by the lower part coming from the upper part of the board, the shadow must necessarily be inverted with respect to the object.

There is a curious phenomenon relating to vision, which some persons have ascribed to the inflection of light, but which Mr Melville explains in a very different and very simple manner.

226 A curious phenomenon explained by Mr Melville.

When any opaque body is held at the distance of three or four inches from the eye, so that a part of some more distant luminous object, such as the window, or the flame of a candle, may be seen by rays passing near its edge, if another opaque body, nearer to the eye, be brought across from the opposite side, the edge of the first body will seem to swell outwards, and meet the latter; and in doing so will intercept a portion of the luminous object that was seen before.

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This appearance he explains in the following manner: Let AB (fig. 7.) represent the luminous object to which the sight is directed, CD the more distant opaque body, GH the nearer, and EF the diameter of the pupil. Join ED, FD, EG, FG, and produce them till they meet AB in K, N, M, and L. It is plain that the parts AN, MB, of the luminous object cannot be seen. But taking any point *a* between N and K, and drawing *a* D *d*, since the portion *d* F of the pupil is filled with light flowing from that point, it must be visible. Any point *b*, between *a* and K, must fill *f* F, a greater portion of the pupil, and therefore must appear brighter. Again, Any point *c*, between *b* and K, must appear brighter than *b*, because it fills a greater portion *g* F with light. The point K itself, and every other point in the space KL, must appear very luminous, since they send entire pencils of rays EKF, ELF, to the eye; and the visible brightness of every point from L towards M, must decrease gradually, as from K to N, that is, the spaces KN, LM, will appear as dim shadowy borders, or fringes, adjacent to the edges of the opaque bodies.

When the edge G is brought to touch the right line KF, the penumbras unite; and as soon as it reaches NDF, the above phenomenon begins; for it cannot pass that right line without meeting some line *a* D *d*, drawn from a point between N and K, and, by intercepting all the rays that fall upon the pupil, render it invisible. In advancing gradually to the line KDE, it will meet other lines *b* D *f*, *c* D *g*, &c, and therefore render the points *b*, *c*, &c. from N to K, successively invisible; and therefore the edge of the fixed opaque body CD must seem to swell outwards, and cover the whole space NK; while GH, by its motion, covers MK. When GH is placed at a greater distance from the eye, CD continuing fixed, the space OP to be passed over in order to intercept NK is less; and therefore, with an equal motion of GH, the apparent swelling of CD must be quicker; which is found true by experience.

If ML represent a luminous object, and REFQ any plane exposed to its light, the space FQ will be entirely shaded from the rays, and the space FE will be occupied by a penumbra, gradually darker, from E to F. Let now GH continue fixed, and CD move parallel to the plane EF; and as soon as it passes the line LF, it is evident that the shadow QF will seem to swell outwards; and when CD reaches ME, so as to cover with its shadow the space RE, QF, by its extension, will cover FE. This is found to hold true likewise by experiment.

### § 4. *Of the Concave Figure of the Sky.*

227 Extent of the visible horizon on a plane surface.

This apparent concavity is only an optical deception founded on the incapacity of our organs of vision to take in very large distances. Dr Smith, in his Complete System of Optics, hath demonstrated, that, if the surface of the earth was perfectly plane, the distance of the visible horizon from the eye would scarce exceed the distance of 5000 times the height of the eye above the ground, supposing the height of the eye between five and six feet: beyond this distance, all

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all objects would appear in the visible horizon. For, let OP be the height of the eye above the line PA drawn upon the ground; and if an object AB, equal in height to PO, be removed to a distance PA equal to 5000 times that height, it will hardly be visible by reason of the smallness of the angle AOB. Consequently any distance AC, how great soever, beyond A, will be invisible. For since AC and BO are parallel, the ray CO will always cut AB in some point D between A and B; and therefore the angle AOC, or AOD, will always be less than AOB, and therefore AD or AC will be invisible. Consequently all objects and clouds, as CE and FG, placed at all distances beyond A, if they be high enough to be visible, or to subtend a bigger angle at the eye than AOB, will appear at the horizon AB; because the distance AC is invisible.

Plate CCCLXI. fig. 8.

228 Why a long row of objects appears circular.

Hence, if we suppose a vast long row of objects, or a vast long wall ABZY (fig. 9.), built upon this plane, and its perpendicular distance OA from the eye at O to be equal to or greater than the distance O *a* of the visible horizon, it will not appear straight, but circular, as if it was built upon the circumference of the horizon *a e g y*: and if the wall be continued to an immense distance, its extreme parts YZ will appear in the horizon at *y z*, where it is cut by a line O *y* parallel to the wall. For, supposing a ray YO, the angle YO *y* will become insensibly small. Imagine this infinite plane OAY *y*, with the wall upon it, to be turned about the horizontal line O like the lid of a box, till it becomes perpendicular to the other half of the horizontal plane LM *y*, and the wall parallel to it, like a vast ceiling overhead; and then the wall will appear like the concave figure of the clouds overhead. But though the wall in the horizon appear in the figure of a semicircle, yet the ceiling will not, but much flatter. Because the horizontal plane was a visible surface, which suggested the idea of the same distances quite round the eye: but in the vertical plane extended between the eye and the ceiling, there is nothing that affects the sense with an idea of its parts but the common line O *y*; consequently the apparent distances of the higher parts of the ceiling will be gradually diminished in ascending from that line. Now when the sky is quite overcast with clouds at equal gravities, they will all float in the air at equal heights above the earth, and consequently will compose a surface resembling a large ceiling, as flat as the visible surface of the earth. Its concavity therefore is not real, but apparent: and when the heights of the clouds are unequal, since their real shapes and magnitudes are all unknown, the eye can seldom distinguish the unequal distances of those clouds that appear in the same directions, unless when they are very near us, or are driven by contrary currents of the air. So that the visible shape of the whole surface remains alike in both cases. And when the sky is either partly overcast or partly free from clouds, it is matter of fact that we retain much the same idea of its concavity as when it was quite overcast.

229 Why the concavity of the sky appears less than a hemisphere.

The concavity of the heavens appears to the eye, which is the only judge of an apparent figure, to be a less portion of a spherical surface than a hemisphere. Dr Smith says, that the centre of the concavity is much below the eye: and by taking a medium among several observations, he found the apparent distance of its parts at the horizon to be generally between three and four times greater than the apparent distance of its parts overhead. For let the arch ABCD represent the apparent concavity of the sky, O the place of the eye, OA and OC the horizontal and vertical apparent distances, whose proportion is required. First observe when the sun or the moon, or any cloud or star, is in such a situation at B, that the apparent arches BA, BC, extended on each side of this object towards the horizon and zenith, seem equal to the eye; then taking the altitude of the object B with a quadrant, or a cross staff, or finding it by astronomy from the given time of observation, the angle AOB is known. Drawing therefore the line OB in the position thus determined, and taking in it any point B at pleasure, in the vertical line CO produced downwards, seek the centre E of a circle ABC, whose arches BA, BC, intercepted between B and the legs of the right angle AOC, shall be equal to each other; then will this arch ABCD represent the apparent figure of the sky. For by the eye we estimate the distance between any two objects in the heavens by the quantity of sky that appears to lie between them; as upon earth we estimate it by the quantity of ground that lies between them. The centre E may be found geometrically by constructing a cubic equation, or as quickly and sufficiently exact by trying whether the chords BA, BC, of the arch ABC drawn by conjecture are equal, and by altering its radius BE till they are so. Now in making several observations upon the sun, and some others upon the moon and stars, they seemed to our author to bisect the vertical arch ABC at B, when their apparent altitudes or the angle AOB was about 23 degrees; which gives the proportion of OC to OA as 3 to 10 or as 1 to $3\frac{1}{3}$ nearly. When the sun was but 30 degrees high, the upper arch seemed always less than the under one; and, in our author's opinion, always greater when the sun was about 18 or 20 degrees high.

Blue colour of the Sky. Fig. 10.

### § 5. *Of the Blue Colour of the Sky, and of Blue and Green Shadows.*

230 Opinions of the ancients respecting the colour of the sky.

The opinions of ancient writers concerning the colour of the sky merit no notice. The first who gave any rational explanation was Fromondus. By him it was supposed, that the blueness of the sky proceeded from a mixture of the white light of the sun with the black space beyond the atmosphere, where there is neither refraction nor reflection. This opinion prevailed very generally even in modern times, and was maintained by Otto Guerick and all his cotemporaries, who asserted, that white and black may be mixed in such a manner as to make a blue. M. Bouguer had recourse to the vapours diffused through the atmosphere, to account for the reflection of the blue rays rather than any other. He seems however to suppose, that it arises from the constitution of the air itself, whereby the fainter coloured rays are incapable of making their way through any considerable tract of it. Hence he is of opinion, that the colour of the air is properly blue; to which opinion Dr Smith seems also to have inclined.

To this blue colour of the sky is owing the appearance of blue and green shadows in the mornings and evenings.

Blue colour of the Sky.

evenings.—These were first taken notice of by M. Buffon in the month of July 1742, when he observed that the shadows of trees which fell upon a white wall were green. He was at that time standing upon an eminence, and the sun was setting in the cleft of a mountain, so that he appeared considerably lower than the horizon. The sky was clear, excepting in the west, which, though free from clouds, was lightly shaded with vapours, of a yellow colour, inclining to red. Then the sun itself was exceedingly red, and was seemingly at least four times as large as he appears to be at mid-day. In these circumstances, he saw very distinctly the shadows of the trees, which were 30 or 40 feet from the white wall, coloured with a light green inclining to blue. The shadow of an arbour which was three feet from the wall, was exactly drawn upon it, and looked as if it had been newly painted with verdigrise. This appearance lasted near five minutes; after which it grew fainter, and vanished at the same time with the light of the sun.

231 Green shadows observed by M. Buffon.

232 Blue shadows observed by him.

The next morning at sunrise, he went to observe other shadows, upon another white wall; but instead of finding them green as he expected, he observed that they were blue, or rather of the colour of lively indigo. The sky was serene, except a slight covering of yellowish vapours in the east; and the sun arose behind a hill, so that it was elevated above his horizon. In these circumstances, the blue shadows were only visible three minutes; after which they appeared black, and in the evening of the same day he observed the green shadows exactly as before. Six days passed without his being able to repeat his observations, on account of the clouds; but the seventh day at sunset, the shadows were not green, but of a beautiful sky-blue. He also observed, that the sky was in a great measure free from vapours at that time; and that the sun set behind a rock, so that it disappeared before it came to his horizon. Afterwards he often observed the shadows both at sunrise and sunset; but always observed them to be blue, though with a great variety of shades of that colour. He showed this phenomenon to many of his friends, who were as much surprised at it as he himself had been; but he says that any person may see a blue shadow, if he will only hold his finger before a piece of white paper at sunrise or sunset.

233 Explanation of these phenomena attempted by Abbé Mazeas.

The first person who attempted to explain this phenomenon was the Abbé Mazeas, in a memoir of the society in Berlin for the year 1752. He observed, that when an opaque body was illuminated by the moon and a candle at the same time, and the two shadows were cast upon the same white wall, that which was enlightened by the candle was reddish, and that which was enlightened by the moon was blue. But, without attending to any other circumstances, he supposed the change of colour to be occasioned by the diminution of the light; but M. Melville, and M. Bouguer, both independent of one another, seem to have hit upon the true cause of this curious appearance, and which hath been already hinted at. The former of these gentlemen, in his attempts to explain the blue colour of the sky, observes, that since it is certain that no body assumes any particular colour, but because it reflects one sort of rays more abundantly than the rest; and since it cannot be supposed that the constituent parts of pure air are gross enough to separate any colours of themselves; we must conclude with Sir Isaac Newton, that the violet and blue-making rays are reflected more copiously than the rest, by the finer vapours diffused through the atmosphere, whose parts are not big enough to give them the appearance of visible opaque clouds. And he shows that in proper circumstances, the bluish colour of the sky light may be actually seen on bodies illuminated by it, as, he says, it is objected should always happen upon this hypothesis. For that if, on a clear cloudless day, a sheet of white paper be exposed to the sun's beams, when any opaque body is placed upon it, the shadow which is illuminated by the sky only will appear remarkably bluish compared with the rest of the paper, which receives the sun's direct rays.

234 Melville's and Bouguer's explanation.

M. Bouguer, who has taken the most pains with this subject, observes, that as M. Buffon mentions the shadows appearing green only twice, and that at all other times they were blue, this is the colour which they regularly have, and that the blue was changed into green by some accidental circumstance. Green, he says, is only a composition of blue and yellow, so that this accidental change may have arisen from the mixture of some yellow rays in the blue shadow; and that perhaps the wall might have had that tinge, so that the blue is the only colour for which a general reason is required. And this, he says, must be derived from the colour of pure air, which always appears blue, and which always reflects that colour upon all objects without distinction; but which is too faint to be perceived when our eyes are strongly affected by the light of the sun, reflected from other objects around us.

To confirm this hypothesis, he adds some curious observations of his own, in which this appearance is agreeably diversified. Being at the village of Boucholtz in July 1764, he observed the shadows projected on the white paper of his pocket-book when the sky was clear. At half an hour past 6 in the evening, when the sun was about four degrees high, he observed that the shadow of his finger was of a dark gray, while he held the paper opposite to the sun; but when he inclined it almost horizontally, the paper had a bluish cast, and the shadow upon it was of a beautiful bright blue.

235 Curious observations relating to this subject.

When his eye was placed between the sun and the paper laid horizontally, it always appeared of a bluish cast; but when he held the paper thus inclined between his eye and the sun, he could distinguish, upon every little eminence occasioned by the inequality of the surface of the paper, the principal of the prismatic colours. He also perceived them upon his nails, and upon the skin of his hand. This multitude of coloured points, red, yellow, green, and blue, almost effaced the natural colour of the objects.

At three quarters past six, the shadows began to be blue, even when the rays of the sun fell perpendicularly. The colour was the most lively when the rays fell upon it at an angle of 45 degrees; but with a less inclination of the paper, he could distinctly perceive, that the blue shadow had a border of a stronger blue on that side which looked towards the sky, and a red border on that side which was turned towards the earth. To see these borders, the body that made the shadow

Different coloured Shadows.

shadow was obliged to be placed very near the paper; and the nearer it was the more sensible was the red border. At the distance of three inches, the whole shadow was blue. At every observation, after having held the paper towards the sky, he turned it towards the earth, which was covered with verdure; holding it in such a manner, that the sun might shine upon it while it received the shadows of various bodies; but in this position he could never perceive the shadow to be blue or green at any inclination with respect to the sun's rays.

At seven o'clock, the sun being still about two degrees high, the shadows were of a bright blue, even when the rays fell perpendicularly upon the paper, but were the brightest when it was inclined at an angle of 45°. At this time he was surprised to observe, that a large tract of sky was not favourable to this blue colour, and that the shadow falling upon the paper placed horizontally was not coloured, or at least the blue was very faint. This singularity, he concluded, arose from the small difference between the light of that part of the paper which received the rays of the sun and that which was in the shade in this situation. In a situation precisely horizontal, the difference would vanish, and there could be no shadow. Thus too much or too little of the sun's light produced, but for different reasons, the same effect; for they both made the blue light reflected from the sky to become insensible. This gentleman never saw any green shadows, but when he made them fall on yellow paper. But he does not absolutely say that green shadows cannot be produced in any other manner; and supposes, that if it was on the same wall that M. Buffon saw the blue shadows, seven days after having seen the green ones, the cause of it might be the mixture of yellow rays, reflected from the vapours, which he observes were of that colour.

236 Blue shadows not confined to the mornings and evenings.

These blue shadows, our author observes, are not confined to the times of the sunrising and sunsetting; on the 19th of July, when the sun has the greatest force, he observed them at three o'clock in the afternoon, but the sun shone through a mist at that time.

If the sky is clear, the shadows begin to be blue; when, if they be projected horizontally, they are eight times as long as the height of the body that produces them, that is, when the centre of the sun is 7° 8′ above the horizon. This observation, he says, was made in the beginning of August.

Besides these coloured shadows, which are produced by the interception of the direct rays of the sun, our author observed others similar to them at every hour of the day, in rooms into which the light of the sun was reflected from some white body, if any part of the clear sky could be seen from the place, and all unnecessary light was excluded as much as possible. Observing these precautions, he says that the blue shadows may be seen at any hour of the day, even with the direct light of the sun; and that this colour will disappear in all those places of the shadow from which the blue sky cannot be seen.

All the observations that our author made upon the yellow or reddish borders of shadows above mentioned, led him to conclude, that they were occasioned by the interception of the sky light, whereby part of the shadow was illuminated either by the red rays reflected from the clouds, when the sun is near the horizon, or from some terrestrial bodies in the neighbourhood. This conjecture is favoured by the necessity he was under of placing any body near the paper, in order to produce this bordered shadow, as he says it is easily demonstrated, that the interception of the sky light can only take place when the breadth of the opaque body is to its distance from the white ground on which the shadow falls, as twice the sine of half the amplitude of the sky to its cosine.

Irradiations of the Sun's Light, &c.

237 Another kind of shadows.

At the conclusion of his observations on these blue shadows, he gives a short account of another kind of them, which, he does not doubt, have the same origin. These he often saw early in the spring when he was reading by the light of a candle in the morning, and consequently the twilight mixed with that of his candle. In these circumstances, the shadow that was made by intercepting the light of his candle, at the distance of about six feet, was of a beautiful and clear blue, which became deeper as the opaque body which made the shadow was brought nearer to the wall, and was exceedingly deep at the distance of a few inches only. But wherever the day light did not come, the shadows were all black without the least mixture of blue.

## § 6. *Of the Irradiations of the Sun's Light appearing through the interstices of the Clouds.*

This is an appearance which every one must have observed when the sky was pretty much overcast with clouds at some distance from each other. At that time several large beams of light, something like the appearance of the light of the sun admitted into a smoky room, will be seen generally with a very considerable degree of divergence, as if the radiant point was situated at no great distance above the clouds. Dr Smith observes that this appearance is one of those which serve to demonstrate that very high and remote objects in the heavens do not appear to us in their real shapes and positions, but according to their perspective projections on the apparent concavity of the sky. He acquaints us, that though these beams are generally seen diverging, as represented in fig. 11. it is not always the case. He himself, in particular, once saw them converging towards a point diametrically opposite to the sun: for, as near as he could conjecture, the point to which they converged was situated as much below the horizon as the sun was then elevated above the opposite part of it. This part is represented by the line $tDt$, and the point below it in opposition to the sun is E; towards which all the beams $vt$, $vt$, &c. appeared to converge.

Plate CCCLXI. 238 Converging irradiations observed by Dr Smith. Fig. 12.

239 The phenomenon explained by him.

"Observing (says our author) that the point of convergence was opposite to the sun, I began to suspect that this unusual phenomenon was but a case of the usual apparent divergence of the beams of the sun from his apparent place among the clouds, as represented in fig. 11. I say an apparent divergence; for though nothing is more common than for rays to diverge from a luminous body, yet the divergence of these beams in such large angles is not real, but apparent. Because it is impossible for the direct rays of the sun to cross one another at any point of the apparent concavity of the sky, in a greater angle than about half a degree. For the

Irradiations of the Sun's Light, &c.

the diameter of the earth being so extremely small, in comparison to the distance of the sun, as to subtend an angle at any point of his body of but 20 or 22 seconds at most; and the diameter of our visible horizon being extremely smaller than that of the earth; it is plain, that all the rays which fall upon the horizon from any given point of the sun, must be inclined to each other in the smallest angles imaginable: the greatest of them being as much smaller than that angle of 22 seconds, as the diameter of the visible horizon is smaller than that of the earth. All the rays that come to us from any given point of the sun may therefore be considered as parallel to each other; as the rays *eBg* from the point *e*, or *fBh* from the opposite point *f*; and consequently the rays of these two pencils that come from opposite points of the sun's real diameter, and cross each other in the sun's apparent place B among the clouds, can constitute no greater an angle with each other than about half a degree; this angle of their intersection *eBf* being the same as the sun would appear under to an eye placed among the clouds at B, or (which is much the same) to an eye at O upon the ground. Because the sun's real distance OS is inconceivably greater than his apparent distance OB. Therefore the rays of the sun, as B*g*, B*h*, do really diverge from his apparent place B in no greater angles *g*B*h* than about half a degree. Nevertheless they appear to diverge from the place B in all possible angles, and even in opposite directions. Let us proceed then to an explanation of this apparent divergence, which is not self-evident by any means; though at first sight we are apt to think it is, by not distinguishing the vast difference between the true and apparent distances of the sun.

Plate CCCLXI. fig. 13.

Fig. 13.

"What I am going to demonstrate is this. Supposing all the rays of the sun to fall accurately parallel to each other upon the visible horizon, as they do very nearly, yet in both cases they must appear to diverge in all possible angles. Let us imagine the heavens to be partly overcast with a spacious bed of broken clouds, *v*, *v*, *v*, &c. lying parallel to the plane of the visible horizon, here represented by the line AOD; and when the sun's rays fall upon these clouds in the parallel lines *s v*, *s v*, &c. let some of them pass through their intervals in the lines *v t*, *v t*, &c. and fall upon the plane of the horizon at the places *t*, *t*, &c. And since the rest of the incident rays *s v*, *s v*, are supposed to be intercepted from the place of the spectator at O by the cloud *x*, and from the intervals between the transmitted rays *v t*, *v t*, &c. by the clouds *v*, *v*, &c. a small part of these latter rays *v t*, *v t*, when reflected every way from some certain kind of thin vapours floating in the air, may undoubtedly be sufficient to affect the eye with an appearance of lights and shades, in the form of bright beams in the places *v t*, *v t*, &c. and of dark ones in the intervals between them; just as the like beams of light and shade appear in a room by reflections of the sun's rays from a smoky or dusty air within it; the lights and shades being here occasioned by the transmission of the rays through some parts of the window, and by their interruption at other parts.

Fig. 14.

"Now, if the apparent concavity of this bed of clouds *v*, *v*, to the eye at O, be represented by the arch ABCD, and be cut in the point B by the line OB*x* drawn parallel to the beams *t v*; it will be evident by the rules of perspective, that these long beams will not appear in their real places, but upon the concave AB CD diverging every way from the place B, where the sun himself appears, or the cloud *x* that covers his body, as represented separately in full view in fig. 11.

"And for the same reason, if the line BO be produced towards E, below the plane of the horizon AOD, and the eye be directed towards the region of the sky directly above E, the lower ends of the same real beams *v t*, *v t*, will now appear upon the part DF of this concave; and will seem to converge towards the point E, situated just as much below the horizon as the opposite point B is above it: which is separately represented in full view in fig. 12.

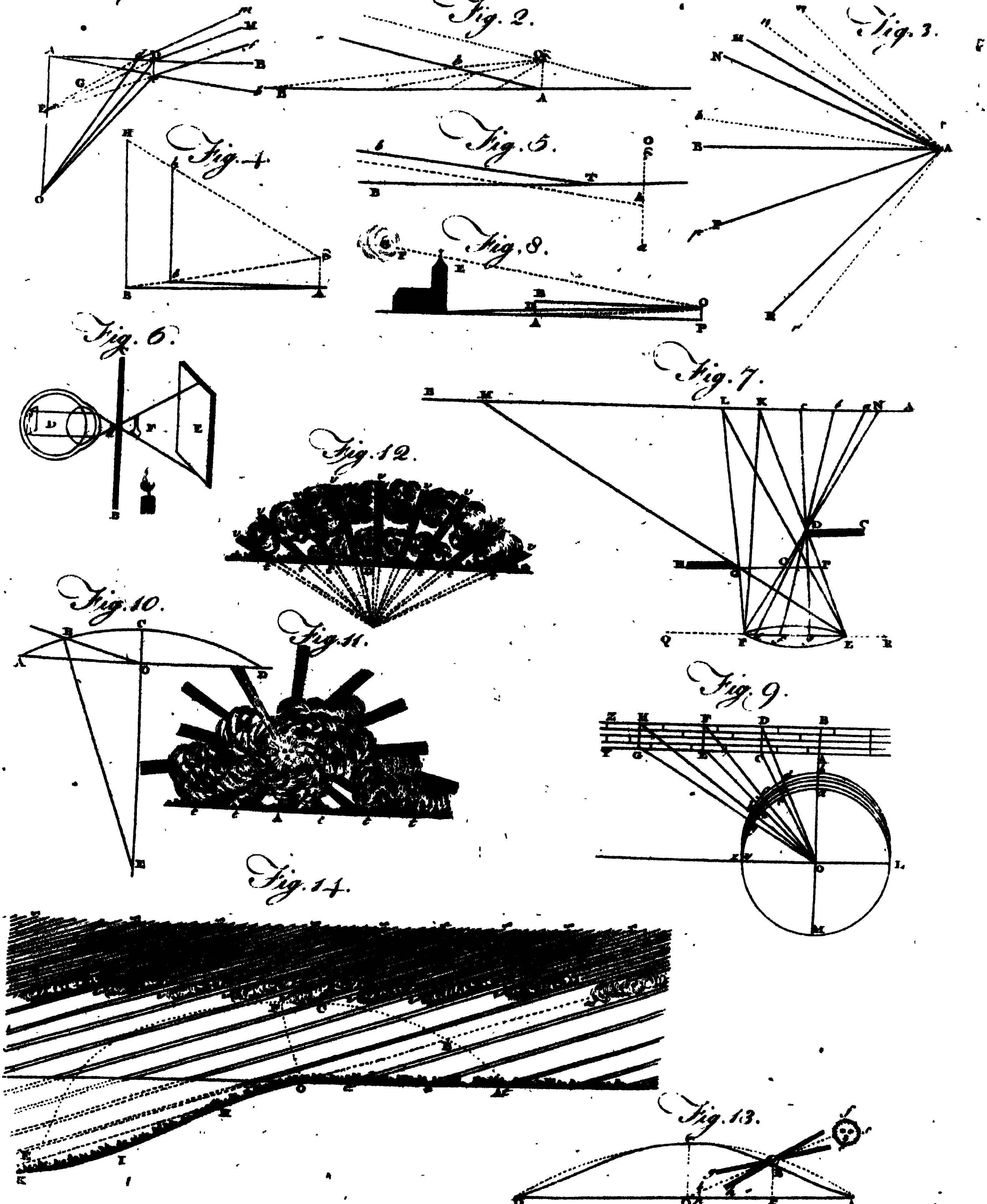
"For if the beams *v t*, *v t*, be supposed to be visible throughout their whole lengths, and the eye be directed in a plane perpendicular to them, here represented by the line OF; they and their intervals will appear broadest in and about this plane, because these parts of them are the nearest to the eye; and therefore their remoter parts and intervals will appear gradually narrower towards the opposite ends of the line BE. As a farther illustration of this matter, we may conceive the spectator at O to be situated upon the top of so large a descent OHI towards a remote valley IK, and the sun to be so very low, that the point E, opposite to him, may be seen above the horizon of this shady valley. In this case it is manifest, that the spectators at O would now see these beams converging so far as to meet each other at the point E in the sky itself.

240 Not observed by moon light.

"I do not remember to have ever seen any phenomenon of this kind by moon light; not so much as of beams diverging from her apparent place. Probably her light is too weak after reflections from any kind of vapours, to cause a sensible appearance of lights and shades so as to form these beams. And in the unusual phenomenon I well remember, that the converging sun beams towards the point below the horizon were not quite so bright and strong as those usually are that diverge from him; and that the sky beyond them appeared very black (several showers having passed that way), which certainly contributed to the evidence of this appearance. Hence it is probable that the thinness and weakness of the reflected rays from the vapours opposite to the sun, is the chief cause that this appearance is so very uncommon in comparison to that other of diverging beams. For as the region of the sky round about the sun is always brighter than the opposite one, so the light of the diverging beams ought also to be brighter than that of the converging ones. For, though rays are reflected from rough unpolished bodies in all possible directions, yet it is a general observation, that more of them are reflected forwards obliquely, than are reflected more directly backwards. Besides, in the present case, the incident rays upon the opposite region to the sun, are more diminished by continual reflections from a longer track of the atmosphere, than the incident rays upon the region next the sun.

241 The phenomenon of diverging beams more frequent in summer than in winter.

"The common phenomenon of diverging beams, I think, is more frequent in summer than in winter, and also when the sun is lower than when higher up; probably because the lower vapours are denser, and therefore more strongly reflective than the higher; because the lower sky light is not so bright as the upper;




A. Bell Prin. Wal. Sculptor fecit.

Illumination of the Shadow of the Earth.

per; because the air is generally quieter in the mornings and evenings than about noon-day; and lastly, because many sorts of vapours are exhaled in greater plenty in summer than in winter, from many kinds of volatile vegetables; which vapours, when the air is cooled and condensed in the mornings and evenings, may become dense enough to reflect a sensible light."

### § 7. *Of the Illumination of the Shadow of the Earth by the refraction of the Atmosphere.*

242 Why the moon is visible when totally eclipsed.

The ancient philosophers, who knew nothing of the refractive power of the atmosphere, were very much perplexed to account for the body of the moon being visible when totally eclipsed. At such times she generally appears of a dull red colour, like tarnished copper, or of iron almost red hot. This, they thought, was the moon's native light, by which she became visible when hid from the brighter light of the sun. Plutarch indeed, in his discourse upon the face of the moon, attributes this appearance to the light of the fixed stars reflected to us by the moon; but this must be by far too weak to produce that effect. The true cause of it is the scattered beams of the sun bent into the earth's shadow by refractions through the atmosphere in the following manner.

Plate CCCLXII. fig. 1.

"Let the body of the sun, says Dr Smith, be represented by the greater circle *ab*, and that of the earth by the lesser one *cd*; and let the lines *ace* and *bde* touch them both on their opposite sides, and meet in *e* beyond the earth; then the angular space *ced* will represent the conic figure of the earth's shadow, which would be totally deprived of the sun's rays, were none of them bent into it by the refractive power of the atmosphere. Let this power just vanish at the circle *bi*, concentric to the earth; so that the rays *ah* and *bi*, which touch its opposite sides, may proceed unrefracted, and meet each other at *k*. Then the two nearest rays to these that flow within them, from the same points *a* and *b*, being refracted inwards through the margin of the atmosphere, will cross each other at a point *l*, somewhat nearer to the earth than *k*; and in like manner, two opposite rays next within the two last will cross each other at a point *m*, somewhat nearer to the earth than *l*, having suffered greater refractions, by passing through longer and denser tracts of air lying somewhat nearer to the earth. The like approach of the successive intersections *k*, *l*, *m*, is to be understood of innumerable couples of rays, till you come to the intersection *n* of the two innermost; which we may suppose just to touch the earth at the points *o* and *p*. It is plain then, that the space bounded by these rays *on*, *np*, will be the only part of the earth's shadow wholly deprived of the sun's rays. Let *fmg* represent part of the moon's orbit when it is nearest to the earth, at a time when the earth's dark shadow *onp* is the longest: in this case I will show that the ratio of *tm* to *tn* is about 4 to 3; and consequently that the moon, though centrally eclipsed at *m*, may yet be visible by means of those scattered rays above mentioned, first transmitted to the moon by refraction through the atmosphere, and from thence reflected to the earth.

Fig. 2.

"For let the incident and emergent parts *aq*, *rn*, of the ray *aqorn*, that just touches the earth at *o*, be produced till they meet at *u*, and let *aqu* produced meet the axis *st* produced in *x*; and joining *us* and *um*, since the refractions of a horizontal ray passing from *o* to *r*, or from *o* to *q*, would be alike and equal, the external angle *nux* is double the quantity of the usual refraction of a horizontal ray; and the angle *aus* is the apparent measure of the sun's semidiameter seen from the earth; and the angle *ust* is that of the earth's semidiameter *tu* seen from the sun (called his *horizontal parallax*); and lastly, the angle *umt* is that of the earth's semidiameter seen from the moon (called her *horizontal parallax*); because the elevation of the point *u* above the earth is too small to make a sensible error in the quantity of these angles; whose measures by astronomical tables are as follow:

| | | | |
|---|---|---|---|
| | The sun's least apparent semidiameter | = ang. *aus* | = 15—50 |
| | The sun's horizontal parallax - | = ang. *ust* | = 00—10 |
| * *Eucl.* I. Prop. 32. | Their difference * is - | = ang. *txu* | = 15—40 |
| | Double the horizontal refraction | = ang. *nux* | = 67—30 |
| *id.* | Their sum † is - | = ang. *tnu* | = 83—10 |
| | The moon's greatest horizontal parallax | = ang. *tmu* | = 62—10 |

Therefore (by a preceding prop.) we have *tm* : *tn* :: (ang. *tnu* : ang. *tmu* :: 83′—10″ : 62′—10″ ::) 4 : 3 in round numbers; which was to be proved. It is easy to collect from the moon's greatest horizontal parallax of 62′—10″, that her least distance *tm* is about $55\frac{1}{7}$ semidiameters of the earth; and therefore the greatest length *tn* of the dark shadow, being three quarters of *tm*, is about $41\frac{1}{4}$ semidiameters.

The difference of the last-mentioned angles *tnu*, *tmu*, is *mun*=21′, that is, about two thirds of 31′—40″, the angle which the whole diameter of the sun subtends at *u*. Whence it follows, that the middle point *m* of the moon centrally eclipsed, is illuminated by rays which come from two-thirds of every diameter of the sun's disk, and pass by one side of the earth; and also by rays that come from the opposite two-thirds of every one of the said diameters, and pass by the other side of the earth. This will appear by conceiving the ray *aqorn* to be inflexible, and its middle point *o* to slide upon the earth, while the part *rn* is approaching to touch the point *m*; for then the opposite part *qa* will trace over two thirds of the sun's diameter. The true proportion of the angles *num*, *aus*, could not be preserved in the scheme, by reason of the sun's immense distance and magnitude with respect to the earth.

Fig. 3.

"Having drawn the line *atα*, it is observable, that all the incident rays, as *aq*, *ακ*, flowing from any one point of the sun to the circumference of the earth, will be collected to a focus *α*, whose distance *tα* is less than *tm* in the ratio of 62 to 67 nearly; and thus an image of the sun will be formed at *αβ*, whose rays



will

Measures of Light.

will diverge upon the moon. For the angle $t\alpha u$ is the difference of the angles $x u \alpha$, $u \alpha t$ found above; and $t\alpha$ : $tm$ :: ang. $tmu$ : ang. $t\alpha u$ :: 62′—10″ : 67—30″.

"The rays that flow next above $aq$ and $a\alpha$, by passing through a thinner part of the atmosphere, will be united at a point in the axis $a t \alpha$ somewhat farther from the earth than the last focus $\alpha$; and the same may be said of the rays that pass next above these, and so on; whereby an infinite series of images of the sun will be formed, whose diameters and degrees of brightness will increase with their distances from the earth.

243 Why the moon appears duller when eclipsed in her perigee than in her apogee.

"Hence it is manifest why the moon eclipsed in her perigee is observed to appear always duller and darker than in her apogee. The reason why her colour is always of the copper kind, between a dull red and orange, I take to be this: The blue colour of a clear sky shows manifestly that the blue-making rays are more copiously reflected from pure air than those of any other colour; consequently they are less copiously transmitted through it among the rest that come from the sun, and so much the less as the tract of air through which they pass is the longer. Hence the common colour of the sun and moon is whitest in the meridian, and grows gradually more inclined to diluted yellow, orange, and red, as they descend lower, that is, as the rays are transmitted through a longer tract of air; which tract being still lengthened in passing to the moon and back again, causes a still greater loss of the blue-making rays in proportion to the rest; and so the resulting colour of the transmitted rays must lie between a dark orange and red, according to Sir Isaac Newton's rule for finding the result of a mixture of colours. We have an instance of the reverse of this case in leaf gold, which appears yellow by reflected and blue by transmitted rays. The circular edge of the shadow in a partial eclipse appears red; because the red-making rays are the least refracted of all others, and consequently are left alone in the conical surface of the shadow, all the rest being refracted into it.

### § 8. *Of the Measures of Light.*

That some luminous bodies give a stronger, and others a weaker light, and that some reflect more light than others, was always obvious to mankind; but no person, before M. Bouguer, hit upon a tolerable method of ascertaining the proportion that two or more lights bear to one another. The methods he most commonly used were the following.

244 M. Bouguer's contrivances for measuring light. Plate CCCLXII.

He took two pieces of wood or pasteboard EC and CD (fig. 4.), in which he made two equal holes P and Q, over which he drew pieces of oiled or white paper. Upon these holes he contrived that the light of the different bodies he was comparing should fall; while he placed a third piece of pasteboard FC, so as to prevent the two lights from mixing with one another. Then placing himself sometimes on one side, and sometimes on the other, but generally on the opposite side of this instrument, with respect to the light, he altered their position till the papers in the two holes appeared to be equally enlightened. This being done, he computed the proportion of their light by the squares of the distances at which the luminous bodies were placed from the objects. If, for instance, the distances were as three and nine, he concluded that the light they gave were as nine and eighty-one. Where any light was very faint, he sometimes made use of lenses, in order to condense it; and he enclosed them in tubes or not as his particular application of them required.

To measure the intensity of light proceeding from the heavenly bodies, or reflected from any part of the sky, he contrived an instrument which resembles a kind of portable camera obscura. He had two tubes, of which the inner was black, fastened at their lower extremities by a hinge C, (fig. 5.) At the bottom of these tubes were two holes, R and S, three or four lines in diameter, covered with two pieces of fine white paper. The two other extremities had each of them a circular aperture, an inch in diameter; and one of the tubes consisted of two, one of them sliding into the other, which produced the same effect as varying the aperture at the end. When this instrument is used, the observer has his head, and the end of the instrument C, so covered, that no light can fall upon his eye, besides that which comes through the two holes S and R, while an assistant manages the instrument, and draws out or shortens the tube DE, as the observer directs. When the two holes appear equally illuminated, the intensity of the lights is judged to be inversely as the squares of the tubes.

In using this instrument, it is necessary that the object should subtend an angle larger than the aperture A or D, seen from the other end of the tube; for, otherwise, the lengthening of the tube has no effect. To avoid, in this case, making the instrument of an inconvenient length, or making the aperture D too narrow, he has recourse to another expedient. He constructs an instrument, represented (fig. 6.), consisting of two object-glasses, AE and DF, exactly equal, fixed in the ends of two tubes six or seven feet, or, in some cases, 10 or 12 feet long, and having their foci at the other ends. At the bottom of these tubes B, are two holes, three or four lines in diameter, covered with a piece of white paper; and this instrument is used exactly like the former.

If the two objects to be observed by this instrument be not equally luminous, the light that issues from them must be reduced to an equality, by diminishing the aperture of one of the object-glasses; and then the remaining surface of the two glasses will give the proportion of their lights. But for this purpose, the central parts of the glass must be covered in the same proportion with the parts near the circumference, leaving the aperture such as is represented (fig. 7.), because the middle part of the glass is thicker and less transparent than the rest.

If all the objects to be observed lie nearly in the same direction, our author observes, that these two long tubes may be reduced into one, the two object-glasses being placed close together, and one eye-glass sufficing for them both. The instrument will then be the same with that of which he published an account in 1748, and which he called a *heliometer*, or *astrometer*.

245 These instruments measure only the intensity of light.

Our author observes, that it is not the absolute quantity, but only the intensity of the light, that is measured by these two instruments, or the number of rays, in proportion to the surface of the luminous body; and it is of great importance that these two things be

Measures of Light.

be distinguished. The intensity of light may be very great, when the quantity, and its power of illuminating other bodies, may be very small, on account of the smallness of its surface; or the contrary may be the case, when the surface is large.

Having explained these methods which M. Bouguer took to measure the different proportions of light, we shall subjoin in this place a few miscellaneous examples of his application of them.

It is observable, that when a person stands in a place where there is a strong light, he cannot distinguish objects that are placed in the shade; nor can he see any thing upon going immediately into a place where there is very little light. It is plain, therefore, that the action of a strong light upon the eye, and also the impression which it leaves upon it, makes it insensible to the effect of a weaker light. M. Bouguer had the curiosity to endeavour to ascertain the proportion between the intensities of the two lights in this case; and by throwing the light of two equal candles upon a board, he found that the shadow made by intercepting the light of one of them, could not be perceived by his eye, upon the place enlightened by the other, at little more than eight times the distance; from whence he concluded, that when one light is eight times eight, or 64 times less than another, its presence or absence will not be perceived. He allows, however, that the effect may be different on different eyes; and supposes that the boundaries in this case, with respect to different persons, may lie between 60 and 80.

Applying the two tubes of his instrument, mentioned above, to measure the intensity of the light reflected from different parts of the sky; he found that when the sun was 25 degrees high, the light was four times stronger at the distance of eight or nine degrees from his body, than it was at 31 or 32 degrees. But what struck him the most was to find, that when the sun is 15 or 20 degrees high, the light decreases on the same parallel to the horizon to 110 or 120 degrees, and then increases again to the place exactly opposite to the sun.

The light of the sun, our author observes, is too strong, and that of the stars too weak, to determine the variation of their light at different altitudes: but as, in both cases, it must be in the same proportion with the diminution of the light of the moon in the same circumstances, he made his observations on that luminary, and found, that its light at 19° 16′, is to its light at 66° 11′, as 1681 to 2500; that is, the one is nearly two thirds of the other. He chose those particular altitudes, because they are those of the sun at the two solstices at Croisic, where he then resided. When one limb of the moon touched the horizon of the sea, its light was 2000 times less than at the altitude of 66° 11′. But this proportion he acknowledges must be subject to many variations, the atmosphere near the earth varying so much in its density. From this observation he concludes, that at a medium light is diminished in the proportion of about 2500 to 1681, in traversing 7469 toises of dense air.

246 Great variation of the light of the moon at different altitudes.

247 Variation in different parts of the disks of the sun and planets.

Lastly, Our accurate philosopher applied his instrument to the different parts of the sun's disk, and found that the centre is considerably more luminous than the extremities of it. As near as he could make the observation, it was more luminous than a part of the disk ¾ths of the semidiameter from it, in the proportion of 35 to 28; which, as he observes, is more than in the proportion of the sines of the angles of obliquity. On the other hand, he observes, that both the primary and secondary planets are more luminous at their edges than near their centres.

The comparison of the light of the sun and moon is a subject that has frequently exercised the thoughts of philosophers; but we find nothing but random conjectures, before our author applied his accurate measures in this case. In general, the light of the moon is imagined to bear a much greater proportion to that of the sun than it really does; and not only are the imaginations of the vulgar, but those of philosophers also, imposed upon with respect to it. It was a great surprise to M. de la Hire to find that he could not, by the help of any burning mirror, collect the beams of the moon in a sufficient quantity to produce the least sensible heat. Other philosophers have since made the like attempts with mirrors of greater power, though without any greater success; but this will not surprise us, when we see the result of M. Bouguer's observations on this subject.

248 M. Bouguer's calculation concerning the light of the moon.

In order to solve this curious problem concerning the comparison of the light of the sun and moon, he compared each of them to that of a candle in a dark room, one in the day-time, and the other in the night following, when the moon was at her mean distance from the earth; and, after many trials, he concluded that the light of the sun is about 300,000 times greater than that of the moon; which is such a disproportion, that, as he observes, it can be no wonder that philosophers have had so little success in their attempts to collect the light of the moon with burning glasses. For the largest of them will not increase the light 1000 times; which will still leave the light of the moon, in the focus of the mirror, 300 times less than the intensity of the common light of the sun.

To this account of the proportion of light which we actually receive from the moon, it cannot be displeasing to the reader, if we compare it with the quantity which would have been transmitted to us from that opaque body, if it reflected all the light it receives. Dr Smith thought that he had proved, from two different considerations, that the light of the full moon would be to our day-light as 1 to about 90,900, if no rays were lost at the moon.

249 Dr Smith's calculation.

In the first place, he supposes that the moon enlightened by the sun, is as luminous as the clouds are at a medium. He therefore supposed the light of the sun to be equal to that of a whole hemisphere of clouds, or as many moons as would cover the surface of the heavens. But on this Dr Priestley observes, that it is true, the light of the sun shining perpendicularly upon any surface would be equal to the light reflected from the whole hemisphere, if every part reflected all the light that fell upon it; but the light that would in fact be received from the whole hemisphere (part of it being received obliquely) would be only one-half as much as would be received from the whole hemisphere, if every part of it shone directly upon the surface to be illuminated.

In his Remarks, par. 97. Dr Smith demonstrates his method of calculation in the following manner:

Measures of Light. Plate CCCLXII. fig. 8.

"Let the little circle *c f d g* represent the moon's body half enlightened by the sun, and the great circle *a e b*, a spherical shell concentric to the moon, and touching the earth; *a b*, any diameter of that shell perpendicular to a great circle of the moon's body, represented by its diameter *c d*; *e* the place of the shell receiving full moon light from the bright hemisphere *f d g*. Now, because the surface of the moon is rough like that of the earth, we may allow that the sun's rays, incident upon any small part of it, with any obliquity, are reflected from it every way alike, as if they were emitted. And therefore, if the segment *d f* shone alone, the points *a*, *e*, would be equally illuminated by it; and likewise if the remaining bright segment *d g* shone alone, the points *b e* would be equally illuminated by it. Consequently, if the light at the point *a* was increased by the light at *b*, it would become equal to the full moon light at *e*. And conceiving the same transfer to be made from every point of the hemispherical surface *b b i k* to their opposite points in the hemisphere *k a e b*, the former hemisphere would be left quite dark, and the latter would be uniformly illuminated with full moon light; arising from a quantity of the sun's light, which immediately before its incidence on the moon, would uniformly illuminate a circular plane equal to a great circle of her body, called her *disk*. Therefore the quantities of light being the same upon both surfaces, the density of the sun's incident light is to the density of full moon light, as that hemispherical surface *b e k* is to the said disk; that is, as any other hemispherical surface whose centre is at the eye, to that part of it which the moon's disk appears to possess very nearly, because it subtends but a small angle at the eye: that is, as radius of the hemisphere to the versed sine of the moon's apparent semidiameter, or as 10,000,000 to $1106\frac{2}{3}$ or as 90,400 to 1; taking the moon's mean horizontal diameter to be 16′ 7″.

"Strictly speaking, this rule compares moon light at the earth with day light at the moon; the medium of which, at her quadratures, is the same as our daylight; but is less at her full in the duplicate ratio of 365 to 366, or thereabout, that is, of the sun's distances from the earth and full moon; and therefore full moon light would be to our day light as about 1 to 90,900, if no rays were lost at the moon.

Fig. 9. "Secondly, I say that full moon light is to any other moon light as the whole disk of the moon to the part that appears enlightened, considered upon a plane surface. For now let the earth be at *b*, and let *d l* be perpendicular to *f g*, and *g m* to *c d*: then it is plain, that *g l* is equal to *d m*; and that *g l* is equal to a perpendicular section of the sun's rays incident upon the arch *d g* which at *b* appears equal to *d m*; the eye being unable to distinguish the unequal distances of its parts. In like manner, conceiving the moon's surface to consist of innumerable physical circles parallel to *e f d g*, as represented at A, the same reason holds for every one of these circles as for *c f d g*. It follows then, that the bright part of the surface visible at *b*, when reduced to a flat as represented at B, by the crescent *p d q m p*, will be equal and similar to a perpendicular section of all the rays incident on that part, represented at C by the crescent *pgqlp*. Now the whole disk being in proportion to this crescent, as the quantities of light incident upon them; and the light falling upon every rough particle, being equally rarefied in diverging to the eye at *b*, considered as equidistant from them all; it follows, that full moon light is to this moon light as the whole disk *p d q c* to the crescent *p d q m p*.

"Therefore, by compounding this ratio with that in the former remark, day light is to moon light as the surface of an hemisphere whose centre is at the eye, to the part of that surface which appears to be possessed by the enlightened part of the moon."

Of Aberration.

250 Mr Michell's calculation.

Mr Michell made his computation in a much more simple and easy manner, and in which there is much less danger of falling into any mistake. Considering the distance of the moon from the sun, and that the density of the light must decrease in the proportion of the square of that distance, he calculated the density of the sun's light, at that distance, in proportion to its density at the surface of the sun; and in this manner he found, that if the moon reflected all the light it receives from the sun, it would only be the 45,000th part of the light we receive from the greater luminary. Admitting, therefore, that moon light is only a 300,000th part of the light of the sun, Mr Michell concludes, that it reflects no more than between the 6th and 7th part of what falls upon it.

## Sect. IV. *Of Aberration.*

251 Theory of aberration.

The great practical use of the science of optics is to aid human sight; but it has been repeatedly observed during the progress of this article, that in constructing dioptrical instruments for this purpose, great difficulties arise from the aberration of light. It has been shown, page 288, &c. how to determine the concourse of any refracted ray PF′ with the ray RVCF′ (figs. 5, 6, &c. Plate CCCLV.) which passes through the centre C, and therefore falls perpendicularly on the spherical surface at the vertex V, and suffers no refraction. This is the conjugate focus to R for the two rays RP, RV, and for another ray flowing from R and falling on the surface at an equal distance on the opposite side to P. In short, it is the conjugate focus for all the rays flowing from R and falling on the spherical surface in the circumference of a circle described by the revolution of the point P round the axis RVCF; that is, of all the rays which occupy the conical surface described by the revolution of RP, and the refracted rays occupy the conical surface produced by the revolution of PF′.

But no other rays flowing from R are collected at F′; for it appeared in the demonstration of that proposition, that rays incident at a greater distance from the axis RC were collected at a point between C and F′; and then the rays which are incident on the whole arch PC, or the spherical surface generated by its revolution round RC, although they all cross the axis RC, are diffused over a certain portion of it, by what has been called the aberration of figure. It is called also (but improperly) the aberration from the geometrical focus, by which is meant the focus of an infinitely slender pencil of rays, of which the middle ray (or axis of the pencil) occupies the lens RC, and suffers

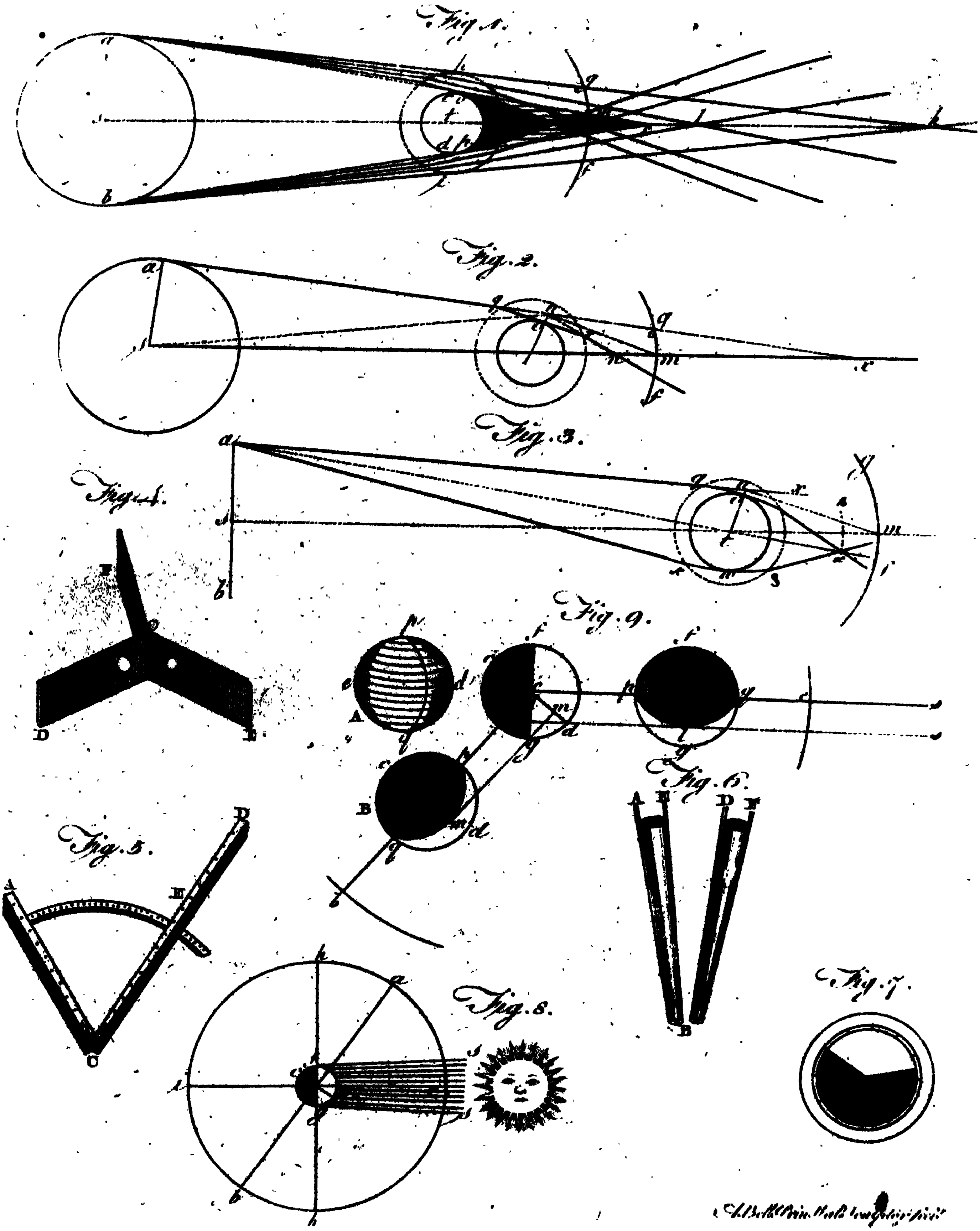


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.

Of Aberration

ſuffers no refraction. But there is no ſuch focus. But if we make $m$RV—$n$RC : $m$RV=VC : VF, the point F is called the geometrical focus, and is the remoteſt limit from C of all the foci (equally geometrical) of rays flowing from R. The other limit is eaſily determined by conſtructing the problem for the extreme point of the given arch.

It is evident from the conſtruction, that while the point of incidence P is near to V, the line CK increaſes but very little, and therefore CF diminiſhes little, and the refracted rays are but little diffuſed from F; and therefore they are much denſer in its vicinity than any other point of the axis. It will ſoon be evident that they are incomparably denſer. It is on this account that the point F has been called the conjugate focus κατ' ἐξοχὴν, to R, and the geometrical focus and the diffuſion has been called *aberration*. A geometrical point R is thus repreſented by a very ſmall circle (or phyſical point as it is improperly called) at F, and F has drawn the chief attention. And as, in the performance of optical inſtruments, it is neceſſary that this extended repreſentation of a mathematical point R be very ſmall, that it may not ſenſibly interfere with the repreſentations of the points adjacent to R, and thus cauſe indiſtinct viſion, a limit is thus ſet to the extent of the refracting ſurface, which muſt be employed to produce this repreſentation. But this evidently diminiſhes the quantity of light, and renders the viſion *obſcure* though diſtinct. Artiſts have therefore endeavoured to execute refracting ſurfaces of forms not ſpherical, which collect accurately to one point the light iſſuing from another, and the mathematicians have furniſhed them with forms having this property; but their attempts have been fruitleſs. Spherical ſurfaces are the only ones which can be executed with accuracy. All are done by grinding the refracting ſubſtance in a mould of proper materials. When this is ſpherical, the two work themſelves, with moderate attention, into an exact ſphere; becauſe if any part is more prominent than another, it is ground away, and the whole gets of neceſſity one curvature. And it is aſtoniſhing to what degree of accuracy this is done. An error of the millionth part of an inch would totally deſtroy the figure of a mirror of an inch focal diſtance, ſo as to make it uſeleſs for the coarſeſt inſtrument. Therefore all attempts to make other figures are given up. Indeed other reaſons make them worſe than ſpherical, even when accurately executed. They would not collect to accurate focuſes the rays of oblique pencils.

It is evident from theſe obſervations, that the theory of aberrations is abſolutely neceſſary for the ſucceſsful conſtruction of optical inſtruments; and it muſt be acceptable to the reader to have a ſhort account of it in this place. Enough ſhall be ſaid here to ſhow the *general* nature and effects of it in optical inſtruments, and in ſome of the more curious phenomena of nature. Under the article TELESCOPE the ſubject will be reſumed, in ſuch a manner as to enable the reader who poſſeſſes a very moderate ſhare of mathematical knowledge, not only to underſtand how aberrations are increaſed and diminiſhed, but alſo how, by a proper employment of contrary aberrations, their hurtful effects may be *almoſt entirely* removed in all important caſes. And the manner in which the ſubject ſhall be treated in the preſent general ſketch, will have the advantage of pointing out at the ſame time the maxims of conſtruction of the greateſt part of optical inſtruments, which generally produce their effects by means of pencils of rays which are either out of the axis altogether, or are oblique to it; caſes which are ſeldom conſidered in elementary treatiſes of optics.

Let PV$\pi$ (fig. 1.) be a ſpherical ſurface of a refracting ſubſtance (glaſs for inſtance), of which C is the centre, and let an indefinitely ſlender pencil of rays AP$ap$ be incident on it, in a direction parallel to a ray CV paſſing through the centre. It is required to determine the focus $f$ of this pencil. Plate CCCLXIII

252 How to remedy the evils of aberration.

Let AP be refracted into PF. Draw CI, CR the ſines of incidence and refraction, and CP the radius. Draw RB perpendicular to CP, and B$f$ parallel to AP or CV. I ſay, firſt, $f$ is the focus of the indefinitely ſlender pencil, or, more accurately ſpeaking, $f$ is the remoteſt limit from P of the concourſe of rays with PF' refracted by points lying without the arch VP, or the neareſt limit for rays incident between V and P.

Draw the radius C$pc'$, the line $pf$; and draw $pg$ parallel to P$f$, and P$o$ perpendicular to P$f$. It is evident, that if $f$ be the focus, $c'pf$ is the angle of refraction correſponding to the angle of incidence, $ap$C as C'P$f$ is the angle correſponding to APC. Alſo PC$p$ is the increment of the angle of incidence, and the angle $c'pg$ is equal to the ſum of the angle C'P$f$ and C'C$c$, and the angle $gpf$ is equal to the angle $pf$P. Therefore $c'pf$=C'P$f$+P,C$p$,+P$fp$. Therefore PC$p$+P$fp$ is the correſponding increment of the angle of refraction. Alſo, becauſe RP$o$=CP$p$ (being right angles) the angle $p$P$o$=RPC, and P$o$ : P$p$= PR : PC.

Therefore by a preceding Lemma in this article, we have PC$p$+P$fp$ : PC$p$=tan. ref. : tan. incid.= T, R : T, I; and P$fp$ : PC$p$=T, R—T, I : T, I, =diff. : T, I; but P$fp$ : PC$p$=$\frac{\text{P}o}{\text{P}f}$ : $\frac{\text{P}p}{\text{P}c}$=$\frac{\text{PR}}{\text{P}f}$ : $\frac{\text{PC}}{\text{PC}}$, =PR : P$f$, = DR DB (becauſe DP is parallel to B$f$ by conſtruction) = tan. CPR—tan. CPI : tan. CPI. Now CPI is the angle of incidence; and therefore CPR is the angle properly correſponding to it as an angle of refraction, and the point $f$ is properly determined. Page 280, &c.

Hence the following rule. As the difference of the tangents of incidence and refraction is to the tangent of incidence, ſo is the radius of the ſurface multiplied by the coſine of refraction to the diſtance of the focus of an infinitely ſlender pencil of parallel incident rays.

*N. B.* We here conſider the coſine of refraction as a number. This was firſt done by the celebrated Leonhard Euler, and is one of the greateſt improvements in mathematics which this century can boaſt of. The ſines, tangents, ſecants, &c. are conſidered as fractional numbers, of which the radius is unity. Thus, CP× ſin. 30°, is the ſame thing with $\frac{1}{2}$CP, or $\frac{\text{CP}}{2}$. And in like manner, CB, drawn perpendicular to the axis× ſin. 19° 28′ 16′ 32″, is the ſame thing with $\frac{1}{3}$ of CB. Alſo $\frac{\text{CB}}{\text{coſ. }60^\circ}$ is the ſame thing with twice CB, &c.

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Of Aberration.

In this manner, BE=BC × fin. BCE, and alfo BE =CE × tan. BCE, and CB=CE × fec. BCE, &c. &c. This manner of confidering the lines which occur in geometrical conftructions is of immenfe ufe in all parts of mixed mathematics; and nowhere more remarkably than in optics, the moft beautiful example of them. Of this an important inftance fhall now be given.

*Corol.* 1. The diftance *f* G of this lateral focus from the axis CV (that is, from the line drawn through the centre parallel to the incident light) is proportional to the cube of the femi-aperture PH of the fpherical furface.

For *f* G=BE. Now BE=CB × fin. BCE, =CB × fin. CPA; and CB=RC × cof. RCB, =RC × fin. CPR, and RC=CP × fin. CPR: Therefore BE=PC × fin.$^2$ CPR × fin. PCA, =PC × fin.$^2$ refr. × fin. incid. but fin.$^2$ refr. $=\frac{m^2}{n^2}$ fin.$^2$ incid. Therefore, finally, BE, or *f* G=PC $\times\frac{m^2}{n^2}\times$ fin.$^3$ incid.: But PC. fin. incid. is evidently PH the femi-aperture; therefore the propofition is manifeft.

*Corol.* 2. Now let this flender pencil of rays be incident at the vertex V. The focus will now be a point F in the axis, determined by making CV : CF=*m*—*n* : *m*. Let the incident pencil gradually recede from the axis CF, ftill, however, keeping parallel to it. The focus *f* will always be found in a curve line DC'F, fo conftituted that the ordinate G will be as the cube of the line PH, perpendicular to the axis intercepted between the axis and that point of the furface which is cut by a tangent to the curve in *f*.

All the refracted rays will be tangents to this curve, and the adjacent rays will crofs each other in thefe lateral foci *f*; and will therefore be incomparably more denfe along the curve than anywhere within its area. This is finely illuftrated by receiving on white paper the light of the fun refracted through a globe or cylinder of glafs filled with water. If the paper is held parallel to the axis of the cylinder, and clofe to it, the illuminated part will be bounded by two very bright parallel lines, where it is cut by the curve; and thefe lines will gradually approach each other as the paper is withdrawn from the veffel, till they coalefce into one very bright line at F, or near it. If the paper be held with its end touching the veffel, and its plane nearly perpendicular to the axis, the whole progrefs at the curve will be diftinctly feen.

As fuch globes were ufed for burning glaffes, the point of greateft condenfation (which is very near but not exactly in F) was called the *focus*. When thefe curves were obferved by Mr Tchirnhaufs, he called them *cauftics*; and thofe formed by refraction he called *diacauftics*, to diftinguifh them from the *catacauftics* formed by reflection.

It is fomewhat furprifing, that thefe curves have been fo little ftudied fince the time of Tchirnhaufs. The doctrine of aberrations has indeed been confidered in a manner independent on their properties. But whoever confiders the progrefs of rays in the eye-piece of optical inftruments, will fee that the knowledge of the properties of diacauftic curves determines directly, and almoft accurately, the foci and images that are formed there. For, let the object-glafs of a telefcope or microfcope be of any dimenfions, the pencils incident on the eye-glaffes are almoft all of this evanefcent bulk. Thefe advantages will be fhown in their proper places: and we proceed at prefent to extend our knowledge of aberrations in general, firft confidering the aberrations of parallel incident rays.

Abiding by the inftance reprefented by the figure, it is evident that the cauftic will touch the furface in a point $\varphi$, fo fituated that $c\varphi : \varphi\chi = m : n$. The refracted ray $\varphi\Phi$ will touch the furface, and will crofs the axis in $\Phi$, the neareft limit of diffufion along the axis. If the furface is of fmaller extent, as PV, the cauftic begins at *f*, when the extreme refracted ray P *f* touches the cauftic, and croffes the axis in F', and the oppofite branch of the cauftic in K. If there be drawn an ordinate KO *k* to the cauftic, it is evident that the whole light incident on the furface PV$\pi$ paffes through the circle whofe diameter is K *k*, and that the circle is the fmalleft fpace which receives *all* the refracted light.

253 How light is diftributed over the fmalleft circle of diffufion.

It is of great importance to confider the manner in which the light is diftributed over the furface of this circle of fmalleft diffufion: for this is the reprefentation of one point of the infinitely diftant radiant object. Each point of a planet, for inftance, is reprefented by this little circle; and as the circles reprefenting the different adjacent points muft interfere with each other, an indiftinctnefs muft arife, fimilar to what is obferved when we view an object through a pair of fpectacles, which do not fit the eye. The indiftinctnefs muft be in proportion to the number of points whofe circles of diffufion interfere; that is, to the area of thefe circles, provided that the light is uniformly diffufed over them: but if it be very rare at the circumference, the impreffion made by the circles belonging to the adjacent points muft be lefs fenfible. Accordingly, Sir Ifaac Newton, fuppofing it incomparably rarer at the circumference than towards the centre, affirms, that the indiftinctnefs of telefcopes arifing from the fpherical figure of the object-glafs was fome thoufand times lefs than that arifing from the unequal refrangibility of light; and therefore, that the attempts to improve them by diminifhing or removing this aberration were needlefs, while the diftinctnefs from unequal refrangibility remained. It is furprifing, that a philofopher fo eminent for fagacity and for mathematical knowledge fhould have made fuch a miftake, and unfortunate that the authority of his great name hindered others from examining the matter, trufting to his affertion, that the light was fo rare at the border of this circle. His miftake is furprifing, becaufe the very nature of a cauftic fhould have fhowed him, that the light was infinitely denfe at the borders of the circle of fmalleft diffufion. The firft perfon who detected this overfight of the Britifh philofopher was the Abbé Bofcovich, who, in a differtation publifhed at Vienna in 1767, fhowed, by a very beautiful analyfis, that the diftribution was extremely different from what Newton had afferted, and that the fuperior indiftinctnefs arifing from unequal refrangibility was incomparably lefs than he had faid. We fhall attempt to make this delicate and interefting matter conceivable by thofe who have but fmall mathematical preparation.

Let the curve DVZCI *c z v d* (fig. 2.) be the cauftic (magnified), EI its axis, I the focus of central rays, D the focus of extreme rays, and IB the line contain- Plate CCCLXIII.

ing

Of Aberration.

in the foci of all the intermediate rays, and CO$c$ the diameter of the circle of smallest diffusion.

It is plain, that from the centre O there can be drawn two rays OV, O$v$, touching the caustic in V, $v$. Therefore the point O will receive the ray EO, which passes through the vertex of the refracting surface, and all the rays which are incident on the circumference of a circle described on the refracting surface by the extremity of the ray OV, or O$v$. The density of the light at O will therefore be indefinitely great.

From the point C there can be drawn two rays; one of them CX touching the caustic in C, and the other C, touching it at $d$ on the opposite side. The rays which touch the caustic in the immediate vicinity of C$y$, both in the arch CV and the arch CI will cut OC in points indefinitely near to each other; because their distance from each other in the line OC will be to their uniform distance on the refracting surface as the distance between their points of contact with the caustic to the distance of these points from the refracting surface. Here therefore at C the density of the light will also be indefinitely great.

From any point H, lying between O and C, may be drawn three rays. One of them LHT, P, touching the arch CD of the caustic in T, cutting the refracting surface in P, and the axis in L: another, $t$ H $p$, touching the arch CI of the caustic in $t$. The third is H $\tau$ $\pi$, touching the arch $c$ $d$ of the opposite branch of the caustic in $\tau$.

It will greatly assist our conceptions of this subject, if we consider a ray of light from the refracting surface as a thread attached at I of this figure, or at F of fig. 1. and gradually unlapped from the caustic DVCI on one side, and then lapped on the opposite branch I $c$ $\kappa$ $d$; and attend to the point of its intersection with the diameter $c$ OC of the circle of smallest diffusion.

Plate CCCLXIII.

Therefore, 1. Let the ray be first supposed to pass through the refracting surface at F, the right hand extremity of the aperture. The thread is then folded up on the whole right hand branch ICVD of the caustic; and if the straight part of it FD be produced, it will cut the diameter of the circle of smallest diffusion in the opposite extremity $c$. Or suppose a ruler in place of the thread, applied to the caustic at D and to the refracting surface at F, the part of it D$c$, which is detached from the caustic, cuts CO$c$ in the point $c$. 2. Now suppose the ruler to revolve gradually, its extremity moving across the arch FA$f$ of the refracting surface while the edge is applied to the caustic; the point of contact with the caustic will shift gradually down the branch DV of the caustic, while its edge passes across the line $c$ C; and when the point of contact arrives at V, the extremity will be at Y on the refracting surface, and the intersection of the edge will be at O. 3. Continuing the motion, the point of contact shifts from V to Z, the extremity from Y to Q', and the intersection from O to Q, so that $OQ^2 = \frac{OC^2}{2}$, as will presently appear. 4. After this, the point of contact will shift from Z to C, the extremity from Q' to X, halfway from F to A, as will soon be shown, and the intersection from Q to C. 5. The point of contact will now shift from C down to I, the extremity will pass from X to A, and the intersection will go back from C to O. 6. The ruler must now be applied to the other branch of the caustic I $c$ $z$ $v$ $d$, and the point of contact will ascend from I to $c$, the extremity will pass from A to $x$, half way to $f$ from A, and the intersection from O to $c$. 7. The point of contact will ascend from C to $z$, the extremity passes from $x$ to $q'$, and the intersection from C to $q$, $Oq^2$ being $= \frac{Oc^2}{2}$. 8. While the contact of the ruler and caustic shifts from $z$ to $v$, the extremity shifts from $q'$ to $y$, and the intersection from $q$ to O. 9. The contact rises from $v$ to $d$, the extremity passes from $y$ to $f$, and the intersection from O to C; and then the motion across the refracting surface is completed, the point of contact shifting down from D to I along the branch DVZCI, and then ascending along the other branch I $c$ $z$ $v$ $d$, while the intersection passes from $c$ to C, back again from C to $c$, and then back again from $c$ to C, where it ends, having thrice passed through every intermediate point of $c$ C.

254 Density of light.

We may form a notion of the density of the light in any point H, by supposing the incident light of uniform density at the refracting surface, and attending to the constipation of the rays in the circle of smallest diffusion. Their vicinity may be estimated both in the direction of the radii OH, and in the direction of the circumference described by its extremity H, during its revolution round the axis; and the density must be conceived as proportional to the *number* of originally equidistant rays, which are collected into a spot of given area. These have been collected from a corresponding spot or area of the refracting surface; and as the number of rays is the same in both, the density at H will be to the density of the refracting surface, as the area occupied of the refracting surface to the corresponding area at H. The vicinity of the rays in the direction of the radius depends on the proportion between PT and TH. For the ray adjacent to PTH may be supposed to cross it at the point of contact T; and therefore the uniform distance between them at the surface of that medium is to the distance between the same rays at H as the distance of T from the refracting surface to its distance from H. Therefore the number of rays which occupy a tenth of an inch, for example, of the radius AP, is to the number which would occupy a tenth of an inch at H as TH to TP; and the radial density at P is to the radial density at H, also as TH to TP. In the next place, The circumferential density at P is to that at H as the radius AP to the radius OH. For supposing the figure to turn round its axis AI, the point P of the refracting surface will describe a circumference whose radius is AP, and H will describe a circumference whose radius is OH; and the whole rays which pass through the first circumference pass also through the last, and therefore their circumferential densities will be in the inverse proportion of the spaces into which they are collected. Now the radius AP is to the radius OH as AL to OL; and circumferences have the same proportion with their radii. Therefore the circumferential density at P is to that in H as AL to OL inversely; and it was found that the radial density was as AN to ON inversely, being as TH to TP, which are very nearly in this ratio. Therefore the absolute density (or number of rays collected in a given space) at P will be to that at H, in the ratio compounded of these ratios; that is, in the ratio of ON $\times$ OL to AN $\times$ AL. But as NL bears but a very small ratio to AN or AL,

Of Aberration.

AN × AL may be taken as equal to AO² without any sensible error. It never differs from it in telescopes 100th part, and is generally incomparably smaller. Therefore the density at H may be considered as proportional to ON × OL inversely. And it will afterwards appear that NS is $=3oL$. Therefore the density at H is inversely as ON × NS.

Now describe a circle on the diameter OS, and draw NT$\varphi$ cutting the circumference $N\varphi^2 = ON \times NS$, and the density at H is as $N\varphi^2$ inversely. This gives us a very easy estimation of the density, viz. draw a line from the point of contact of the ray which touches the part VC of the caustic, and the density is in the inverse subduplicate ratio of the part of this line intercepted between the axis and the circumference S$\varphi$O. It will afterwards appear that the density corresponding to this ray is one half of the density corresponding to all the three: or a better expression will be had for the density at H by drawing R$\beta$ perpendicular to R$\varphi$, and $\beta o$ perpendicular to $\varphi\beta$, making $\varphi$R in $o$; then $\varphi o$ is as $\frac{1}{\varphi N^2}$, or is proportional to the density, as is evident.

When H is at O, N is at S, and $\varphi o$ is infinite. As H moves from O, N descends, and $\varphi o$ diminishes, till H comes to Q, and T to $z$, and $\varphi$ to $\zeta$, and $o$ to R. When H moves from Q towards C, T descends below $z$, $\varphi o$ again increases, till it is again infinite, when H is at C, T at C, and N at O.

Thus it appears, without any minute consideration, that the light has a density indefinitely great in the centre O; that the density decreases to a minimum in some intermediate point Q, and then increases again to infinity at the margin C. Hence it follows, that the indistinctness arising from the spherical figure of the refracting surfaces is incomparably greater than Newton supposed; and that the valuable discovery of Mr Dollond of achromatic lenses, must have failed of answering his fond expectations, if his very method of producing them had not, at the same time, enabled him to remove that other indistinctness by employing contrary aberrations. And now, since the discoveries by Dr Blair of substances which disperse the different colours in the same proportions, but very different degrees, has enabled us to employ much larger portions of the sphere than Mr Dollond could introduce into his object-glasses, it becomes absolutely necessary to study this matter completely, in order to discover and ascertain the amount of the errors which perhaps unavoidably remain.

255 Contrary aberrations correct each other.

This slight sketch of the most simple case of aberration, namely, when the incident rays are parallel, will serve to give a general notion of the subject; and the reader can now see how contrary aberrations may be employed in order to form an ultimate image which shall be as distinct as possible. For let it be proposed to converge parallel rays accurately to the focus F (fig. 3.) by the refraction of spherical surfaces of which V is the vertex. Let PV be a convex lens of such a form that rays flowing from F and passing through it immediately round the vertex V are collected to the conjugate focus R, while the extreme ray FP, incident on the margin of the lens P, is converged to $r$, nearer to V, having the longitudinal aberration R$r$. Let $p$V be a plano-concave lens, of such sphericity

Plate CCCLXIII

Of the Multiplying glass.

that a ray A$p$, parallel to the axis CV, and incident on the point $p$, as far from its vertex V as P in the other lens is from its vertex, is dispersed from $r$, the distance $\varrho$V being equal to $r$V, while the central rays are dispersed from P, as far from V as R is from V. It is evident, that if these lenses be joined as in fig. , a ray A'$p$, parallel to the common axis CV, will be collected at the distance VF equal to VF in the fig. 4 and that rays passing through both lenses in the neighbourhood of the axis will be collected at the same point F.

This compound lens is said to be without spherical aberration; and it is true that the central and the extreme rays are collected in the same point F: but the rays which fall on the lens between the centre and margin are a little diffused from F, and it is not possible to collect them all to one point. For in the rules for computing the aberration, quantities are neglected which do not preserve (in different apertures) the same ratio to the quantities retained. The diffusion is least when the aberration is corrected, not for the very extremity, but for a certain intermediate point (varying with the aperture, and having no known ratio to it); and when this is done the compound lens is in its state of greatest perfection, and the remaining aberration is quite insensible.

This subject will be resumed under the article TELESCOPE, and prosecuted as far as the construction of optical instruments requires.

## SECT. IV. *Of Optical Instruments.*

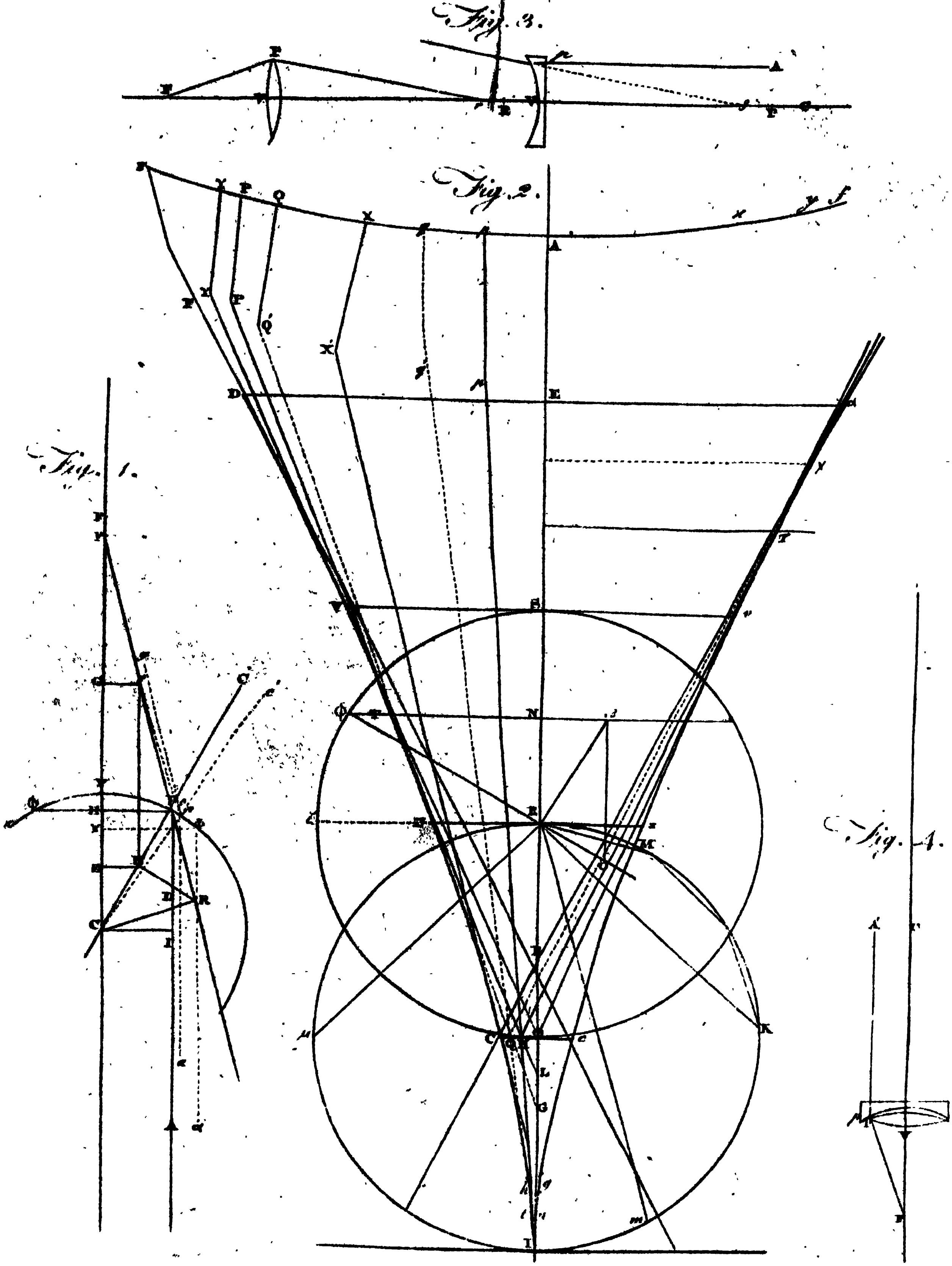
OF the mechanism of optical instruments, particular accounts are given in this work under their respective denominations. These it would be improper to repeat; but as it belongs to the science of optics to explain, by the laws of refraction and reflection, the several phenomena which those instruments exhibit, we must in this place enumerate the instruments themselves, omitting entirely, or stating very briefly, such facts as are stated at large in other places. In this enumeration we shall begin with the *multiplying glass*, not because it is first in importance, but that it may not intervene between instruments more useful, and which have a mutual relation to one another.

### § 1. *The Multiplying Glass.*

Plate CCCLXI

256 Phenomena of the multiplying glass.

The multiplying glass is made by grinding down the round side $bik$ (fig. 1.) of a plano-convex glass AB, into several flat surfaces, as $hb$, $bld$, $dk$. An object C will not appear magnified when seen through this glass by the eye at H; but it will appear multiplied into as many different objects as the glass contains plane surfaces. For, since rays will flow from the object C to all parts of the glass, and each plane surface will refract these rays to the eye, the same object will appear to the eye in the direction of the rays which enter it through each surface. Thus, a ray $gi$H, falling perpendicularly on the middle surface, will go through the glass to the eye without suffering any refraction; and will therefore show the object in its true place at C: whilst a ray $ab$ flowing from the same object, and falling obliquely on the plane surface $bb$, will be refracted in the direction $be$, by passing through the glass; and, upon leaving it, will go on to the eye in the direction $e$H; which will cause




A. Bell Prin. Wal. Sculptor fecit.

Plane Mirrors.

cause the same object C to appear also at E, in the direction of the ray H *e*, produced in the right line H *e n*. And the ray *c d*, flowing from the object C, and falling obliquely on the plane surface *d k*, will be refracted (by passing through the glass, and leaving it at *f*) to the eye at H; which will cause the same object to appear at D, in the direction H *f m*.—If the glass be turned round the line *g l* H, as an axis, the object C will keep its place, because the surface *b l d* is not removed; but all the other objects will seem to go round C, because the oblique planes, on which the rays *abcd* fall, will go round by the turning of the glass.

§ 2. *Mirrors.*

It has been elsewhere observed, that of mirrors there are three principally used in optical experiments (See CATOPTRICS, Sect. I.); the plane mirror, the spherical convex mirror, and the spherical concave mirror. Of these the plane mirror first claims our attention, as it is more common, and undoubtedly more ancient, than the other two. It has been said (*ubi supra*), that the image reflected by this mirror appears as far behind the surface as the object is before it; that the image will appear of the same size and in the same position with the object; that every such mirror will reflect an image of twice its own length and breadth; and that in certain circumstances it will reflect several images of the same object. For these phenomena it is our business in this place to account by the laws of reflection.

Plate CCCLXIV.

Let AB (fig. 2.) be an object placed before the reflecting surface *g h i* of the plane mirror CD; and let the eye be at *o*. Let A*h* be a ray of light flowing from the top A of the object, and falling upon the mirror at *h*, and *hm* be a perpendicular to the surface of the mirror at *h*; the ray A*h* will be reflected from the mirror to the eye at *o*, making an angle *mho* equal to the angle A*hm*: then will the top of the image E appear to the eye in the direction of the reflected ray *oh* produced to E, where the right line A*p*E, from the top of the object, cuts the right line *oh*E, at E. Let B*i* be a ray of light proceeding from the foot of the object at B to the mirror at *i*; and *ni* a perpendicular to the mirror from the point *i*, where the ray B *i* falls upon it; this ray will be reflected in the line *io*, making an angle *nio* equal to the angle B*in*, with that perpendicular, and entering the eye at *o*; then will the foot F of the image appear in the direction of the reflected ray *oi*, produced to F, where the right line BF cuts the reflected ray produced to F. All the other rays that flow from the intermediate points of the object AB, and fall upon the mirror between *h* and *i*, will be reflected to the eye at *o*; and all the intermediate points of the image EF will appear to the eye in the direction of these reflected rays produced. But all the rays that flow from the object and fall upon the mirror above *h*, will be reflected back above the eye at *o*; and all the rays that flow from the object, and fall upon the mirror below *i*, will be reflected back below the eye at *o*; so that none of the rays that fall above *h*, or below *i*, can be reflected to the eye at *o*; and the distance between *h* and *i* is equal to half the length of the object AB.

257 Size of a looking-glass in which a man may see his whole image.

Hence it appears, that if a man sees his whole image in a plane looking-glass, the part of the glass that reflects his image must be just half as long and half as broad as himself, let him stand at any distance from it whatever; and that his image must appear just as far behind the glass as he is before it. Thus, the man AB (fig. 3.) viewing himself in the plane mirror CD, which is just half as long as himself, sees his whole image as at EF, behind the glass, exactly equal to his own size. For a ray AC proceeding from his eye at A, and falling perpendicularly upon the surface of the glass at C, is reflected back to his eye, in the same line CA; and the eye of his image will appear at E, in the same line produced to E, beyond the glass. And a ray BD, flowing from his foot, and falling obliquely on the glass at D, will be reflected as obliquely on the other side of the perpendicular *ab*D, in the direction DA; and the foot of his image will appear at F, in the direction of the reflected ray AD, produced to F, where it is cut by the right line BGF, drawn parallel to the right line ACE. Just the same as if the glass were taken away, and the real man stood at F, equal in size to the man standing at B: for to his eye at A, the eye of the other man at E would be seen in the direction of the line ACE; and the foot of the man at F would be seen by the eye A, in the direction of the line ADF.

If the glass be brought nearer the man AB, as suppose to *cb*, he will see his image as at CDG: for the reflected ray CA (being perpendicular to the glass) will show the eye of the image as at C; and the incident ray B*b*, being reflected in the line *b*A, will show the foot of his image as at G; the angle of reflection *ab*A being always equal to the angle of incidence B*ba*: and so of all the intermediate rays from A to B. Hence, if the man AB advances towards the glass CD, his image will approach towards it; and if he recedes from the glass, his image will also recede from it.

If the object be placed before a common looking-glass, and viewed obliquely, three, four, or more images of it, will appear behind the glass.

Plate CCCLIX.

To explain this, let ABCD (fig. 11.) represent the glass; and let EF be the axis of a pencil of rays flowing from E, a point in an object situated there. The rays of this pencil will in part be reflected at F, suppose into the line FG. What remains will (after refraction at F, which we do not consider here) pass on to H; from whence (on account of the quicksilver which is spread over the second surface of glasses of this kind to prevent any of the rays from being transmitted there) they will be strongly reflected to K, where part of them will emerge and enter an eye at L. By this means one representation of the said point will be formed in the line LK produced, suppose in M: Again, Another pencil, whose axis is EN, first reflected at N, then at O, and afterwards at P, will form a second representation of the same point at Q: And, thirdly, Another pencil, whose axis is ER, after reflection at the several points R, S, H, T, V, successively, will exhibit a third representation of the same point at X; and so on *in infinitum*. The same being true of each point in the object, the whole will be represented in the like manner; but the representations will be faint, in proportion to the number of reflections the rays suffer, and the length of their progress within the glass.

258 Why three or four images of objects are seen in plane mirrors.

Concave and convex Mirrors.

glass. We may add to these another representation of the same object in the line LO produced, made by such of the rays as fall upon O, and are from thence reflected to the eye at L.

This experiment may be tried by placing a candle before the glass as at E, and viewing it obliquely, as from L.

2. *Of Concave and Convex Mirrors.* The effects of these in magnifying and diminishing objects have been already in general explained; but for the better understanding the nature of reflecting telescopes, it will still be proper to subjoin the following particular description of the effects of concave ones.

Plate CCCLXIV.

When parallel rays (fig. 4.), as *dfa*, C*mb*, *elc*, fall upon a concave mirror AB (which is not transparent, but has only the surface A*b*B of a clear polish, they will be reflected back from that mirror, and meet in a point *m*, at half the distance of the surface of the mirror from C the centre of its concavity; for they will be reflected at as great an angle from a perpendicular to the surface of the mirror, as they fell upon it with regard to that perpendicular, but on the other side thereof. Thus, let C be the centre of concavity of the mirror A*b*B; and let the parallel rays *dfa*, C*mb*, and *elc*, fall upon it at the points *a*, *b*, and *c*. Draw the lines C*ia*, C*mb*, and C*bc*, from the centre C to these points; and all these lines will be perpendicular to the surface of the mirror, because they proceed thereto like so many radii or spokes from its centre. Make the angle C*ab* equal to the angle *da*C, and draw the line *amb*, which will be the direction of the ray *dfa*, after it is reflected from the point *a* of the mirror; so that the angle of incidence *da*C is equal to the angle of reflection C*ab*; the rays making equal angles with the perpendicular C*ia* on its opposite sides.

Draw also the perpendicular C*bc* to the point *c*, where the ray *elc* touches the mirror; and having made the angle C*ci* equal to the angle C*ce*, draw the line *cmi*, which will be the course of the ray *elc*, after it is reflected from the mirror.

The ray C*mb* passing through the centre of concavity of the mirror, and falling upon it at *b*, is perpendicular to it; and is therefore reflected back from it in the same line *bm*C.

All these reflected rays meet in the point *m*; and in that point the image of the body which emits the parallel rays *da*, C*b*, and *ec*, will be formed; which point is distant from the mirror equal to half the radius *bm*C of its concavity.

The rays which proceed from any celestial object may be esteemed parallel at the earth; and therefore the image of that object will be formed at *m*, when the reflecting surface of the concave mirror is turned directly towards the object. Hence, the focus *m* of parallel rays is not in the centre of the mirror's concavity, but half way between the mirror and that centre.

The rays which proceed from any remote terrestrial object are nearly parallel at the mirror: not strictly so, but come diverging to it, in separate pencils, or as it were bundles of rays, from each point of the side of the object next the mirror; and therefore they will not be converged to a point at the distance of half the radius of the mirror's concavity from its reflecting surface, but into separate points at a little greater distance from the mirror. And the nearer the object is to the mirror, the farther these points will be from it; and an inverted image of the object will be formed in them, which will seem to hang pendant in the air; and will be seen by an eye placed beyond it (with regard to the mirror) in all respects like the object, and as distinct as the object itself.

259 Aerial images formed by concave mirrors.

Let A*c*B (fig. 5.) be the reflecting surface of a mirror, whose centre of concavity is at C; and let the upright object DE be placed beyond the centre C, and send out a conical pencil of diverging rays from its upper extremity D, to every point of the concave surface of the mirror A*c*B. But to avoid confusion, we only draw three rays of that pencil, as DA, D*c*, DB.

From the centre of concavity C, draw the three right lines CA, C*c*, CB, touching the mirror in the same points where the foresaid rays touch it; and all these lines will be perpendicular to the surface of the mirror. Make the angle CA*d* equal to the angle DAC, and draw the right line A*d* for the course of the reflected ray DA: make the angle C*cd* equal to the angle D*c*C, and draw the right line *cd* for the course of the reflected ray D*d*: make also the angle CB*d* equal to the angle DBC, and draw the right line B*d* for the course of the reflected ray DB. All these reflected rays will meet in the point *d*, where they will form the extremity *d* of the inverted image *ed* similar to the extremity D of the upright object DE.

If the pencil of rays E*f*, E*g*, E*h*, be also continued to the mirror, and their angles of reflection from it be made equal to their angles of incidence upon it, as in the former pencil from D, they will all meet at the point *e* by reflection, and form the extremity *e* of the image *ed*, similar to the extremity E of the object DE.

And as each intermediate point of the object, between D and E, sends out a pencil of rays in like manner to every part of the mirror, the rays of each pencil will be reflected back from it, and meet in all the intermediate points between the extremities *e* and *d* of the image; and so the whole image will be formed, not at *i*, half the distance of the mirror from its centre of concavity C, but at a greater distance between *i* and the object DE; and the image will be inverted with respect to the object.

This being well understood, the reader will easily see how the image is formed by the large concave mirror of the reflecting telescope, when he comes to the description of that instrument.

When the object is more remote from the mirror than its centre of concavity C, the image will be less than the object, and between the object and mirror: when the object is nearer than the centre of concavity, the image will be more remote and bigger than the object. Thus, if ED be the object, *de* will be its image: For, as the object recedes from the mirror, the image approaches nearer to it; and as the object approaches nearer to the mirror, the image recedes farther from it; on account of the lesser or greater divergency of the pencils of rays which proceed from the object: for the less they diverge, the sooner they are converged to points by reflection; and the more they

they diverge, the farther they must be reflected before they meet.

If the radius of the mirror's concavity, and the distance of the object from it, be known, the distance of the image from the mirror is found by this rule: Divide the product of the distance and radius by double the distance made less by the radius, and the quotient is the distance required.

If the object be in the centre of the mirror's concavity, the image and object will be coincident, and equal in bulk.

If a man places himself directly before a large concave mirror, but farther from it than its centre of concavity, he will see an inverted image of himself in the air, between him and the mirror, of a less size than himself. And if he holds out his hand towards the mirror, the hand of the image will come out towards his hand, and coincide with it, of an equal bulk, when his hand is in the centre of concavity; and he will imagine he may shake hands with his image. If he reaches his hand farther, the hand of the image will pass by his hand, and come between his hand and his body: and if he moves his hand towards either side, the hand of the image will move towards the other; so that whatever way the object moves, the image will move the contrary.

All the while a bystander will see nothing of the image, because none of the reflected rays that form it enter his eyes.

## § 3. *Microscopes.*

Under the word MICROSCOPE a copious detail has been given of the construction of those instruments as they are now made by the most eminent artists. In that article it fell not within our plan to treat scientifically of their magnifying powers: these can be explained only by the laws of refraction and reflection, which we shall therefore apply to a few microscopes, leaving our readers to make the application themselves to such others as they may choose to analyze by optical principles.

The first and simplest of all microscopes is nothing more than a very small globule of glass, or a convex lens whose focal distance is extremely short. The magnifying power of this microscope is thus ascertained by Dr Smith. "A minute object $pq$, seen distinctly through a small glass AE by the eye put close to it, appears so much greater than it would to the naked eye, placed at the least distance $q$L from whence it appears sufficiently distinct, as this latter distance $q$L is greater than the former $q$E. For having put your eye close to the glass EA, in order to see as much of the object as possible at one view, remove the object $pq$ to and fro till it appear most distinctly, suppose at the distance E$q$. Then conceiving the glass AE to be removed, and a thin plate, with a pin-hole in it, to be put in its place, the object will appear distinct and as large as before, when seen through the glass, only not so bright. And in this latter case it appears so much greater than it does to the naked eye at the distance $q$L, either with a pin-hole or without it, as the angle $p$E$q$ is greater than the angle $p$L$q$, or as the latter distance $q$L is greater than the former $q$E. Since the interposition of the glass has no other effect than to render the appearance distinct, by helping the eye to increase the refraction of the rays in each pencil, it is plain that the greater apparent magnitude is entirely owing to a nearer view than could be taken by the naked eye. As the human eye is so constructed, as, for reasons already assigned, to have distinct vision only when the rays which fall upon it are parallel or nearly so; it follows that if the eye be so perfect as to see distinctly by pencils of parallel rays falling upon it, the distance E$q$, of the object from the glass, is then the focal distance of the glass. Now, if the glass be a small round globule, of about $\frac{1}{15}$th of an inch diameter, its focal distance E$q$, being three quarters of its diameter, is $\frac{1}{20}$th of an inch; and if $q$L be eight inches, the distance at which we usually view minute objects, this globule will magnify in the proportion of 8 to $\frac{1}{20}$, or of 160 to 1.

Plate CCCLXIV figs. 6, 7.

2. *The Double or Compound Microscope*, (fig. 8.) consists of an object-glass $c\,d$, and an eye-glass $e\,f$. The small object $a\,b$ is placed at a little greater distance from the glass $c\,d$ than its principal focus; so that the pencils of rays flowing from the different points of the object, and passing through the glass, may be made to converge, and unite in as many points between $g$ and $h$, where the image of the object will be formed; which image is viewed by the eye through the eye-glass $e\,f$. For the eye-glass being so placed, that the image $g\,h$ may be in its focus, and the eye much about the same distance on the other side, the rays of each pencil will be parallel after going out of the eye-glass, as at $e$ and $f$, till they come to the eye at $k$, where they will begin to converge by the refractive power of the humours; and after having crossed each other in the pupil, and passed through the crystalline and vitreous humours, they will be collected into points on the retina, and form the large inverted image AB thereon.

260 Use of several lenses in a compound microscope.

By this combination of lenses, the aberration of the light from the figure of the glass, which in a globule of the kind above-mentioned is very considerable, is in some measure corrected. This appeared so sensibly to be the case, even to former opticians, that they very soon began to make the addition of another lens. The instrument, however, receives a considerable improvement by the addition of a third lens. For, says Mr Martin, it is not only evident from the theory of this aberration, that the image of any point is rendered less confused by refraction thro' two lenses than by an equal refraction through one; but it also follows, from the same principle, that the same point has its image still less confused when formed by rays refracted through three lenses than by an equal refraction through two; and therefore a third lens added to the other two will contribute to make the image more distinct, and consequently the instrument more complete. At the same time the field of view is amplified, and the use of the microscope rendered more agreeable, by the addition of the other lens. Thus also we may allow a somewhat larger aperture to the object lens, and thereby increase the brightness of objects, and greatly heighten the pleasure of viewing them. For the same reason, Mr Martin has proposed a four-glass microscope, which answers the purposes of magnifying and of distinct vision still more perfectly.

The magnifying power of double microscopes is easily

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ſily underſtood, thus: The glaſs L next the object PQ is very ſmall, and very much convex, and conſequently its focal diſtance LF is very ſhort; the diſtance LQ of the ſmall object PQ is but a little greater than LF: Greater it muſt be, that the rays flowing from the object may converge after paſſing through the glaſs, and croſſing one another, form an image of the object; and it muſt be but a little greater, that the image *pq* may be at a great diſtance from the glaſs, and conſequently may be much larger than the object itſelf. This picture *pq* being viewed through a convex glaſs AE, whoſe focal diſtance is *q* E, appears diſtinct as in a teleſcope. Now the object appears magnified upon two accounts; firſt, becauſe, if we viewed its picture *pq* with the naked eye, it would appear as much greater than the object, at the ſame diſtance, as it really is greater than the object, or as much as L*q* is greater than LQ; and ſecondly, becauſe this picture appears magnified through the eye-glaſs as much as the leaſt diſtance at which it can be ſeen diſtinctly with the naked eye, is greater than *q* E, the focal diſtance of the eye-glaſs. For example, if this latter ratio be five to one, and the former ratio of L*q* to LQ be 20 to 1; then, upon both accounts, the object will appear 5 times 20, or 100 times greater than to the naked eye.

Plate CCLXIV Fig. 9.

Fig. 10. repreſents the ſection of a compound microſcope with three lenſes. By the middle one GK the pencils of rays coming from the object-glaſs are refracted ſo as to tend to a focus at O; but being intercepted by the proper eye-glaſs DF, they are brought together at I, which is nearer to that lens than its proper focus at L; ſo that the angle DIF, under which the object now appears, is larger than DLF, under which it would have appeared without this additional glaſs; and conſequently the object is more magnified in the ſame proportion. Dr Hooke tells us, that, in moſt of his obſervations, he made uſe of a double microſcope with this broad middle glaſs when he wanted to ſee much of an object at one view, and taking it out when he would examine the ſmall parts of an object more accurately; for the fewer refractions there are, the more bright and clear the object appears.

261 The magnifying power of Dr Smith's microſcope.

Having in the hiſtorical part of this article given a practical account of the conſtruction of Dr Smith's double reflecting microſcope, it may not be improper in this place to aſcertain its magnifying power. This we ſhall do from the author himſelf, becauſe his ſymbols, being general, are applicable to ſuch microſcopes of all dimenſions; and though the mere practical reader may perhaps be at firſt ſight puzzled by them, yet, if he will ſubſtitute any particular numbers for *m* and *n*, &c. he may aſcertain with eaſe the magnifying power of ſuch a microſcope of thoſe particular dimenſions.

Fig. 11.

Between the centre E and principal focus T of a concave ſpeculum ABC, whoſe axis is EQTC, place an object PQ; and let the rays flowing from it be reflected from the ſpeculum AB towards an image *pq*; but before they unite in it, let them be received by a convex ſpeculum *abc*, and thence be reflected, through a hole BC in the vertex of the concave, to a ſecond image $\varpi\kappa$, to be viewed through an eye-glaſs *l*.

The object may be ſituated between the ſpecula C, *c*; or, which is better, between the principal focus *t* and vertex *c* of the convex one, a ſmall hole being made in its vertex for the incident rays to paſs through.

In both caſes we have TQ, TE, T*q*, continual proportionals in ſome given ratio, ſuppoſe of 1 to *n*; and alſo *tq*, *tc*, $t\kappa$, continual proportionals in ſome other given ratio, ſuppoſe of 1 to *m*. Then if *d* be the uſual diſtance at which we view minute objects diſtinctly with the naked eye, and $\kappa l$ the focal diſtance of the leaſt eye-glaſs, through which the object appears ſufficiently bright and diſtinct, it will be magnified in the ratio of $mnd$ to $\kappa l$.

For the object PQ, and its firſt image *pq*, are terminated on one ſide by the common axis of the ſpecula, and on the other by a line PE*p*, drawn through the centre E of the concave ABC. Likewiſe the images *pq* and $\varpi\kappa$ are terminated by the common axis and by the line $ep\varpi$, drawn through the centre *e* of the convex *abc* *. Hence, by the ſimilar triangles $\varpi\kappa e$, *pqe*, and alſo *pq*E, PQE, we have $\varpi\kappa : pq :: \kappa e : qe :: m : 1$, and $pq : PQ :: qE : QE :: n : 1$; and conſequently $\varpi\kappa : PQ :: mn : 1$, whence $\varpi\kappa = mn \times PQ$. Now if $l\kappa$ be the focal diſtance of the eye-glaſs *l*, the points P, Q, of the object, are ſeen through it by the rays of two pencils emerging parallel to the lines $\varpi l$ $\kappa l$ reſpectively; that is, PQ appears under an angle equal to $\varpi l \kappa$, which is as $\frac{\varpi\kappa}{\kappa l} = \frac{mnPQ}{\kappa l}$; and to the naked eye at the diſtance *d* from PQ, it appears under an angle P*o*Q which is as $\frac{PQ}{d}$, and therefore is magnified in the ratio of theſe angles, that is, of $mnd$ to $\kappa l$.

* Eucl. v. 12.

*Corol.* Having the numbers *m*, *n*, *d*, to find an eye-glaſs which ſhall cauſe the microſcope to magnify M times in diameter, take $\kappa l = \frac{mnd}{M}$. For the apparent magnitude is to the true as $M : 1 :: mnd : \kappa l$.

262 An eaſy method of aſcertaining the magnifying power of the moſt common microſcopes.

We ſhall conclude this part of our ſubject with the following eaſy method of aſcertaining the magnifying power of ſuch microſcopes as are moſt in uſe.

The apparent magnitude of any object, as muſt appear from what hath been already delivered, is meaſured by the angle under which it is ſeen; and this angle is greater or ſmaller according as the object is near to or far from the eye; and of conſequence the leſs the diſtance at which it can be viewed the larger it will appear. The naked eye is unable to diſtinguiſh any object brought exceedingly near it: but looking through a convex lens, however near the focus of that lens be, there an object may be diſtinctly ſeen; and the ſmaller the lens is, the nearer will be its focus, and in the ſame proportion the greater will be its magnifying power. From theſe principles it is eaſy to find the reaſon why the firſt or greateſt magnifiers are ſo extremely minute; and alſo to calculate the magnifying power of any convex lens employed in a ſingle microſcope: For as the proportion of the natural ſight is to the focus, ſuch will be its power of magnifying. If the focus of a convex lens, for inſtance, be at one inch, and the natural ſight at eight inches, which is the common ſtandard, an object may be ſeen through that lens at one inch diſtance from the eye, and will appear in its diameter eight times larger than

than it does to the naked eye; but as the object is magnified every way, in length as well as in breadth, we must square this diameter to know how much it really is enlarged; and we then find that its superficies is magnified 64 times.

263 Further observations on the magnifying power of microscopes.

Again, Suppose a convex lens whose focus is only one-tenth of an inch distant from its centre; as in eight inches, the common distance of distinct vision with the naked eye, there are 80 such tenths, an object may be seen through this glass 80 times nearer than with the naked eye. It will, of consequence, appear 80 times longer, and as much broader, than it does to common sight; and therefore is 6400 times magnified. If a convex glass be so small that its focus is only $\frac{1}{20}$ of an inch distant, we find that eight inches contain 160 of these twentieth parts; and of consequence the length and breadth of any object seen through such a lens will be magnified 160 times, and the whole surface 25,600 times. As it is an easy matter to melt a drop or globule of a much smaller diameter than a lens can be ground; and as the focus of a globule is no farther off than a quarter of its own diameter, it must of consequence magnify to a prodigious degree. But this excessive magnifying power is much more than counterbalanced by its admitting so little light, want of distinctness, and showing such a minute part of the object to be examined; for which reason, these globules, though greatly in vogue some time ago, are now almost entirely rejected. Mr Leeuwenhoek, as has been already observed, made use only of single microscopes consisting of convex lenses, and left to the Royal Society a legacy of 26 of those glasses. According to Mr Folkes's description of these, they were all exceedingly clear, and showed the object very bright and distinct; "which (says Mr Folkes), must be owing to the great care this gentleman took in the choice of his glass, his exactness in giving it the true figure, and afterwards, among many, reserving only such for his use as upon trial he found to be most excellent. Their powers of magnifying are different, as different objects may require: and as on the one hand, being all ground glasses, none of them are so small, or consequently magnify to so great a degree, as some of those drops frequently used in other microscopes; yet, on the other hand, the distinctness of these very much exceeds what I have met with in glasses of that sort. And this was what Mr Leeuwenhoek ever proposed to himself; rejecting all those degrees of magnifying in which he could not so well obtain that end. For he informs us in one of his letters, that though he had above 40 years by him glasses of an extraordinary smallness, he had made but very little use of them; as having found, in a long course of experience, that the most considerable discoveries were to be made with such glasses as, magnifying but moderately, exhibited the object with the greatest brightness and distinction."

In a single microscope, if you want to learn the magnifying power of any glass, no more is necessary than to bring it to its true focus, the exact place whereof will be known by an object's appearing perfectly distinct and sharp when placed there. Then, with a pair of small compasses, measure, as nearly as you can, the distance from the centre of the glass to the object you was viewing, and afterwards applying the compasses to any ruler, with a diagonal scale of the parts of an inch marked on it, you will easily find how many parts of an inch the said distance is. When that is known, compute how many times those parts of an inch are contained in eight inches, the common standard of sight, and that will give you the number of times the diameter is magnified; squaring the diameter will give the superficies; and, if you would learn the solid contents, it will be shown by multiplying the superficies by the diameter.

The superficies of one side of an object only can be seen at one view; and to compute how much that is magnified, is most commonly sufficient: but sometimes it is satisfactory to know how many minute objects are contained in a larger; as suppose we desire to know how many animalcules are contained in the bulk of a grain of sand: and to answer this, the cube, as well as the surface, must be taken into the account. For the greater satisfaction of those who are not much versed in these matters, we shall here subjoin the following

TABLE

Micro-scopes.

The Refracting Telescope.

TABLE of the MAGNIFYING POWERS of CONVEX GLASSES, employed in *Single Microscopes*, according to the distance of their focus: Calculated by the scale of an inch divided into 100 parts. Showing how many times the DIAMETER, the SUPERFICIES, and the CUBE of an OBJECCT, is magnified, when viewed through such glasses, to an eye whose natural sight is at eight inches, or 800 of the 100dth parts of an inch.

| The focus of a glass at (hundredth parts of an inch) | Magnifies the Diameter. | Magnifies the Superficies. | Magnifies the Cube of an Object. (Times.) |
|---|---|---|---|
| $\frac{1}{2}$, or 50 | 16 | 256 | 4,096 |
| $\frac{4}{10}$, or 40 | 20 | 400 | 8,000 |
| $\frac{3}{10}$, or 30 | 26 | 676 | 17,576 |
| $\frac{1}{5}$, or 20 | 40 | 1,600 | 64,000 |
| 15 | 53 | 2,809 | 148,877 |
| 14 | 57 | 3,249 | 185,193 |
| 13 | 61 | 3,721 | 226,981 |
| 12 | 66 | 4,356 | 287,496 |
| 11 | 72 | 5,184 | 373,240 |
| $\frac{1}{10}$ or 10 | 80 | 6,400 | 512,000 |
| 9 | 88 | 7,744 | 681,472 |
| 8 | 100 | 10,000 | 1,000,000 |
| 7 | 114 | 12,996 | 1,481,544 |
| 6 | 133 | 17,689 | 2,352,637 |
| $\frac{1}{20}$, or 5 | 160 | 25,600 | 4,096,000 |
| 4 | 200 | 40,000 | 8,000,000 |
| 3 | 266 | 70,756 | 18,821,096 |
| $\frac{1}{50}$, or 2 | 400 | 160,000 | 64,000,000 |
| 1 | 800 | 640,000 | 512,000,000 |

The greatest magnifier in Mr Leeuwenhoek's cabinet of microscopes, presented to the Royal Society, has its focus, as nearly as can well be measured, at one-twentieth of an inch distance from its centre; and consequently magnifies the diameter of an object 160 times, and the superficies 25,600. But the greatest magnifier in Mr Wilson's single microscopes, as they are now made, has usually its focus at no farther distance than about the 50th part of an inch; whereby it has a power of enlarging the diameter of an object 400, and its superficies 160,000 times.

264 The magnifying power of the solar microscope different from that of others.

The magnifying power of the solar microscope must be calculated in a different manner; for here the difference between the focus of the magnifier and the distance of the screen or sheet whereon the image of the object is cast, is the proportion of its being magnified. Suppose, for instance, the lens made use of has its focus half an inch, and the screen is placed at the distance of five feet, the object will then appear magnified in the proportion of five feet to half an inch: and as in five feet there are 120 half inches, the diameter will be magnified 120 times; and the superficies 14,400 times; and, by putting the screen at farther distances, you may magnify the object almost as much as you please: but Mr Baker advises to regard distinctness more than bigness, and to place the screen just at that distance where the object is seen most distinct and clear.

With regard to the double reflecting microscope, Mr Baker observes, that the power of the object-lens is indeed greatly increased by the addition of two eye-glasses; but as no object-lens can be used with them of so minute a diameter, or which magnifies of itself near so much as those that can be used alone, the glasses of this microscope, upon the whole, magnify little or nothing more than those of Mr Wilson's single one; the chief advantage arising from a combination of lenses being the sight of a larger field or portion of an object magnified in the same degree.

### § 4. *Telescopes*.

#### I. The REFRACTING TELESCOPE.

265 Nature of the astronomical telescope.

After what has been said concerning the structure of the compound microscope, and the manner in which the rays pass through it to the eye, the nature of the common astronomical telescope will easily be understood: for it differs from the microscope only in that the object is placed at so great a distance from it, that the rays of the same pencil, flowing from thence, may be considered as falling parallel to one another upon the object-glass; and therefore the image made by that glass is looked upon as coincident with its focus of parallel rays.

Plate CCCLXIV

1. This will appear very plain from the 12th figure, in which AB is the object emitting the several pencils of rays A *c d*, B *c d*, &c. but supposed to be at so great a distance from the object-glass, *c d*, that the rays of the same pencil may be considered as parallel to each other; they are therefore supposed to be collected into their respective foci at the points [illegible] situated at the focal distance [illegible] the object-glass *c d*. Here [illegible] image E, and crossing each other proceed diverging to the eye-glass *h g*; which being placed at its own focal distance from the points *m* and *p*, the rays of each pencil, after passing through that glass, will become parallel among themselves; but the pencils themselves will converge considerably with respect to one another, even so as to cross at *e*, very little farther from the glass *g h* than its focus; because, when they entered the glass, their axes were almost parallel, as coming through the object-glass at the point *k*, to whose

Refracting Telescope. whose distance the breadth of the eye-glass in a long telescope bears very small proportion. So that the place of the eye will be nearly at the focal distance of the eye-glass, and the rays of each respective pencil being parallel among themselves, and their axes crossing each other in a larger angle than they would do if the object were to be seen by the naked eye, vision will be distinct, and the object will appear magnified.

266 Magnifying power of. The power of magnifying in this telescope is as the focal length of the object-glass to the focal length of the eye-glass.

Dem. In order to prove this, we may consider the angle A*k*B as that under which the object would be seen by the naked eye; for in considering the distance of the object, the length of the telescope may be omitted, as bearing no proportion to it. Now the angle under which the object is seen by means of the telescope is *g e h*, which is to the other A*k*B, or its equal *g k h*, as the distance from the centre of the object-glass to that of the eye-glass. The angle, therefore, under which an object appears to an eye assisted by a telescope of this kind, is to that under which it would be seen without it, as the focal length of the object-glass to the focal length of the eye-glass.

It is evident from the figure, that the visible area, or space which can be seen at one view when we look through this telescope, depends on the breadth of the eye-glass, and not of the object-glass; for if the eye-glass be too small to receive the rays *g m*, *p h*, the extremities of the object could not have been seen at all: a larger breadth of the object-glass conduces only to the rendering each point of the image more luminous by receiving a larger pencil of rays from each point of the object.

267 Objects seen through, inverted. It is in this telescope as in the compound microscope, where we see, when we look through it, not the object itself, but only an image of it at CED: now that image being inverted with respect to the object, as it is, because the axes of the pencils that flow from the object cross each other at *k*, objects seen through a telescope of this kind necessarily appear inverted.

This is a circumstance not at all regarded by astronomers: but for viewing objects upon the earth, it is convenient that the telescope should represent them in their natural posture; to which use the telescope with three eye-glasses, as represented fig. 13. is peculiarly adapted, and the progress of the rays through it from the object to the eye is as follows: Plate CCCLXIV.

268 Common refracting telescope shows objects erect. AB is the object sending out the several pencils A*cd*, B*cd*, &c. which passing through the object-glass *c d*, are collected into their respective foci in CD, where they form an inverted image. From hence they proceed to the first eye-glass *e f*, whose focus being at *l*, the rays of each pencil are rendered parallel among themselves, and their axes, which were nearly parallel before, are made to converge and cross each other: the second eye-glass *g h*, being so placed that its focus shall fall upon *m*, renders the axes of the pencils which diverge from thence parallel, and causes the rays of each, which were parallel among themselves, to meet again at its focus EF on the other side, where they form a second image inverted with respect to the former, but erect with respect to the object. Now this image being seen by the eye at *a b* through the eye-glass *i k*, affords a direct representation of the object, and under the same angle that the first image CD would have appeared, had the eye been placed at *l*, supposing the eye-glasses to be of equal convexity; and therefore the object is seen equally magnified in this as in the former telescope, that is, as the focal distance of the object-glass to that of any one of the eye-glasses, and appears erect.

If a telescope exceeds 20 feet, it is of no use in viewing objects upon the surface of the earth; for if it magnifies above 90 or 100 times, as those of that length usually do, the vapours which continually float near the earth in great plenty, will be so magnified as to render vision obscure.

269 Galilean telescope. Plate CCCLXV. 2. *The Galilean Telescope* with the concave eye-glass is constructed as follows:

AB (fig. 1.) is an object sending forth the pencils of rays *g h i*, *k l m*, &c. which, after passing through the object-glass *c d*, tend towards *e*E*f* (where we will suppose the focus of it to be), in order to form an inverted image there as before; but in their way to it are made to pass through the concave glass *n o*, so placed that its focus may fall upon E, and consequently the rays of the several pencils which were converging towards those respective focal points *e*, E, *f*, will be rendered parallel among themselves: but the axes of those pencils crossing each other at F, and diverging from thence, will be rendered more diverging, as represented in the figure. Now these rays entering the pupil of an eye, will form a large and distinct image *a b* upon the retina, which will be inverted with respect to the object, because the axis of the pencils cross in F. The object of course will be seen erect, and the angle under which it will appear will be equal to that which the lines *a*F, *b*F, produced back through the eye-glass, form at F.

It is evident, that the less the pupil of the eye is, the less is the visible area seen through a telescope of this kind; for a less pupil would exclude such pencils as proceed from the extremities of the object AB, as is evident from the figure. This is an inconvenience that renders this telescope unfit for many uses; and is only to be remedied by the telescope with the convex eye-glasses, where the rays which form the extreme parts of the image are brought together in order to enter the pupil of the eye, as explained above.

It is apparent also, that the nearer the eye is placed to the eye-glass of this telescope, the larger is the area seen through it; for, being placed close to the glass, as in the figure, it admits rays that come from A and B, the extremities of the object, which it could not if it was placed farther off.

270 Magnifying power of. The degree of magnifying in this telescope is in the same proportion with that in the other, *viz.* as the focal distance of the object-glass is to the focal distance of the eye-glass.

For there is no other difference but this, *viz.* that as the extreme pencils in that telescope were made to converge and form the angle *g e h* (fig. 12.), or *i n k* (fig. 13.), these are now made to diverge and form the angle *a*F*b* (fig. 1.); which angles, if the concave glass in one has an equal refractive power with the convex one in the other, will be equal, and therefore each kind will exhibit the object magnified in the same degree. Plate CCCLXIV. Plate CCCLXV.

There is a defect in all these kinds of telescopes, not to be remedied in a single lens by any means whatever, which was thought only to arise from hence, viz.

Refracting Teleſcope.

viz. that ſpherical glaſſes do not collect rays to one and the ſame point. But it was happily diſcovered by Sir Iſaac Newton, that the imperfection of this ſort of teleſcope, ſo far as it ariſes from the ſpherical form of the glaſſes, bears almoſt no proportion to that which is owing to the different refrangibility of light. This diverſity in the refraction of rays is about a 28th part of the whole; ſo that the object-glaſs of a teleſcope cannot collect the rays which flow from any one point in the object into a leſs room than the circular ſpace whoſe diameter is about the 56th part of the breadth of the glaſs.

Plate CCCLXV.

To ſhow this, let AB (fig. 2.) repreſent a convex lens, and let CDF be a pencil of rays flowing from the point D; let H be the point at which the leaſt refrangible rays are collected to a focus; and I, that where the moſt refrangible concur. Then, if IH be the 28th part of EH, IK will be a proportionable part of EC (the triangles HIK and HEC being ſimilar): conſequently LK will be the 28th part of FC. But MN will be the leaſt ſpace into which the rays will be collected, as appears by their progreſs repreſented in the figure. Now MN is but about half of KL; and therefore it is about the 56th part of CF; ſo that the diameter of the ſpace into which the rays are collected will be about the 56th part of the breadth of that part of the glaſs through which the rays paſs; which was to be ſhown.

Since therefore each point of the object will be repreſented in ſo large a ſpace, and the centres of thoſe ſpaces will be contiguous, becauſe the points in the object the rays flow from are ſo; it is evident, that the image of an object made by ſuch a glaſs muſt be a moſt confuſed repreſentation, though it does not appear ſo when viewed through an eye-glaſs that magnifies in a moderate degree; conſequently the degree of magnifying in the eye-glaſs muſt not be too great with reſpect to that of the object-glaſs, leſt the confuſion become ſenſible.

Notwithſtanding this imperfection, a dioptrical teleſcope may be made to magnify in any given degree, provided it be of ſufficient length; for the greater the focal diſtance of the object-glaſs is, the leſs may be the proportion which the focal diſtance of the eye-glaſs may bear to that of the object-glaſs, without rendering the image obſcure. Thus, an object-glaſs, whoſe focal diſtance is about four feet, will admit of an eye-glaſs whoſe focal diſtance ſhall be little more than an inch, and conſequently will magnify almoſt 48 times; but an object-glaſs of 40 feet focus will admit of an eye-glaſs of only four inches focus, and will therefore magnify 120 times; and an object-glaſs of 100 feet focus will admit of an eye-glaſs of little more than ſix inches focus, and will therefore magnify almoſt 200 times.

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Refracting teleſcopes magnify in proportion to their length.

The reaſon of this diſproportion in their ſeveral degrees of magnifying is to be explained in the following manner: Since the diameter of the ſpaces, into which rays flowing from the ſeveral points of an object are collected, are as the breadth of the object-glaſs, it is evident that the degree of confuſedneſs in the image is as the breadth of that glaſs; for the degree of confuſedneſs will only be as the diameters or breadths of thoſe ſpaces, and not as the ſpaces themſelves. Now the focal length of the eye-glaſs, that is, its power of magnifying, muſt be as that degree; for, if it exceeds it, it will render the confuſedneſs ſenſible; and therefore it muſt be as the breadth or diameter of the object-glaſs. The diameter of the object-glaſs, which is as the ſquare root of its aperture or magnitude, muſt be as the ſquare root of the power of magnifying in the teleſcope; for unleſs the aperture itſelf be as the power of magnifying, the image will want light: the ſquare root of the power of magnifying will be as the ſquare root of the focal diſtance of the object-glaſs; and therefore the focal diſtance of the eye-glaſs muſt be only as the ſquare root of that of the object-glaſs. So that in making uſe of an object-glaſs of a longer focus, ſuppoſe, than one that is given, you are not obliged to apply an eye-glaſs of a proportionably longer focus than what would ſuit the given object-glaſs, but ſuch an one only whoſe focal diſtance ſhall be to the focal diſtance of that which will ſuit the given object-glaſs, as the ſquare root of the focal length of the object-glaſs you make uſe of, is to the ſquare root of the focal length of the given one. And this is the reaſon that longer teleſcopes are capable of magnifying in a greater degree than ſhorter ones, without rendering the object confuſed or coloured.

272
Their imperfections remedied by Dollond and Blair.

3. But the inconveniency of very long teleſcopes is ſo great, that different attempts have been made to remove it. Of theſe, the moſt ſucceſsful have been by Dollond and Blair; and the general principles upon which theſe eminent opticians proceeded have been mentioned in the hiſtorical part of this article, and in the preceding ſection. The public will ſoon be favoured with a fuller account of Dr Blair's diſcovery from his own pen; and of Dollond's, it may be ſufficient to obſerve, in addition to what has been already ſaid, that the object-glaſſes of his teleſcopes are compoſed of three diſtinct lenſes, two convex and one concave; of which the concave one is placed in the middle, as is repreſented in fig. 3. where *a* and *c* ſhow the two convex lenſes, and *b b* the concave one, which is by the Britiſh artiſts placed in the middle. The two convex ones are made of London crown glaſs, and the middle one of white flint glaſs; and they are all ground to ſpheres of different radii, according to the refractive powers of the different kinds of glaſs and the intended focal diſtance of the object-glaſs of the teleſcope. According to Boſcovich, the focal diſtance of the parallel rays for the concave lens is one-half, and for the convex glaſs one-third of the combined focus. When put together, they refract the rays in the following manner. Let *a b*, *a b* (fig. 4.), be two red rays of the ſun's light falling parallel on the firſt convex lens *c*. Suppoſing there was no other lens preſent but that one, they would then be converged into the lines *b e*, *b e*, and at laſt meet in the focus *q*. Let the lines *g h*, *g h*, repreſent two violet rays falling on the ſurface of the lens. Theſe are alſo refracted, and will meet in a focus; but as they have a greater degree of refrangibility than the red rays, they muſt of conſequence converge more by the ſame power of refraction in the glaſs, and meet ſooner in a focus, ſuppoſe at *r*.—Let now the concave lens *d d* be placed in ſuch a manner as to intercept all the rays before they come to their focus. Were this lens made of the ſame materials, and ground to the ſame radius with the convex one, it would

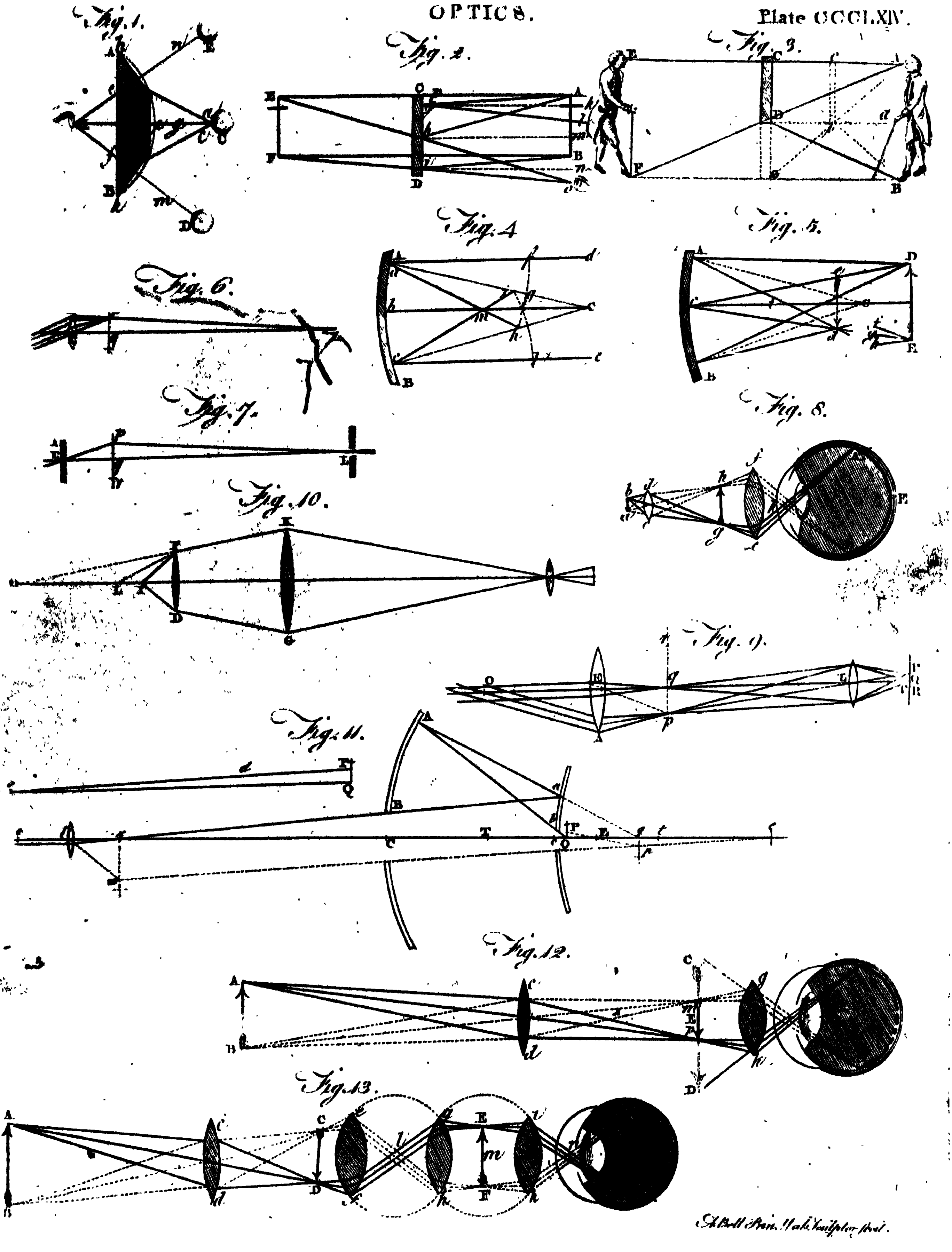


Fig. 1.
Fig. 2.
Fig. 3.
Fig. 4.
Fig. 5.
Fig. 6.
Fig. 7.
Fig. 8.
Fig. 9.
Fig. 10.
Fig. 11.
Fig. 12.
Fig. 13.

Refracting Telescope.

would have the same power to cause the rays diverge that the former had to make them converge. In this case, the red rays would become parallel, and move on in the line *o o, o o:* But the concave lens, being made of flint glass, and upon a shorter radius, has a greater refractive power, and therefore they diverge a little after they come out of it; and if no third lens was interposed, they would proceed diverging in the lines *o p t, o p t;* but, by the interposition of the third lens *o v o*, they are again made to converge, and meet in a focus somewhat more distant than the former, as at *x*. By the concave lens the violet rays are also refracted, and made to diverge: but having a greater degree of refrangibility, the same power of refraction makes them diverge somewhat more than the red ones; and thus, if no third lens was interposed, they would proceed in such lines as [illegible] *n*. Now as the differently coloured rays fall upon the third lens with different degrees of divergence, it is plain, that the same power of refraction in that lens will operate upon them in such a manner as to bring them all together to a focus very nearly at the same point. The red rays, it is true, require the greatest power of refraction to bring them to a focus; but they fall upon the lens with the least degree of divergence. The violet rays, though they require the least power of refraction, yet have the greatest degree of divergence; and thus all meet together in the point *x*, or very nearly so.

But, though we have hitherto supposed the refraction of the concave lens to be greater than that of the convex ones, it is easy to see how the errors occasioned by the first lens may be corrected by it, though it should have even a less power of refraction than the convex one. Thus, let *a b, a b* (fig. 5 ), be two rays of red light falling upon the convex lens *c*, and refracted into the focus *q;* let also *g h, g h*, be two violet rays converged into a focus at *r;* it is not necessary, in order to their convergence into a common focus at *x*, that the concave lens should make them *diverge:* it is sufficient if the glass has a power of dispersing the violet rays somewhat more than the red ones; and many kinds of glass have this power of dispersing some kinds of rays, without a very great power of refraction. It is better, however, to have the object-glass composed of three lenses; because there is then another correction of the aberration by means of the third lens; and it might be impossible to find two lenses, the errors of which would exactly correct each other. It is also easy to see, that the effect may be the same whether the concave glass is a portion of the same sphere with the others or not; the effect depending upon a combination of certain circumstances, of which there is an infinite variety.

ate .XV.

By means of this correction of the errors arising from the different refrangibility of the rays of light, it is possible to shorten dioptric telescopes considerably, and yet leave them equal magnifying powers. The reason of this is, that the errors arising from the object-glass being removed, those which are occasioned by the eye-glass are inconsiderable: for the error is always in proportion to the length of the focus in any glass; and in very long telescopes it becomes exceedingly great, being no less than $\frac{1}{18}$th of the whole; but in glasses of a few inches focus it becomes trifling. Refracting telescopes, which go by the name of *Dollond's*, are therefore now constructed in the following manner. Let AB (fig. 6.) represent an object-glass composed of three lenses as above described, and converging the rays 1, 2, 3, 4, &c. to a very distant focus as at *x*. By means of the interposed lens CD, however, they are converged to one much nearer, as at *y*, where an image of the object is formed. The rays diverging from thence fall upon another lens EF, where the pencils are rendered parallel, and an eye placed near that lens would see the object magnified and very distinct. To enlarge the magnifying power still more, however, the pencils thus become parallel are made to fall upon another at GH; by which they are again made to converge to a distant focus: but, being intercepted by the lens IK, they are made to meet at the nearer one *z;* whence diverging to LM, they are again rendered parallel, and the eye at N sees the object very distinctly.

Reflecting Telescope.

From an inspection of the figure it is evident, that Dollond's telescope thus constructed is in fact two telescopes combined together; the first ending with the lens EF, and the second with LM. In the first we do not perceive the object itself, but the image of it formed at *y;* and in the second we perceive only the image of that image formed at *z*. Nevertheless such telescopes are exceedingly distinct, and represent objects so clearly as to be preferred, in viewing terrestrial things, even to reflectors themselves. The latter indeed have greatly the advantage in their powers of magnifying, but they are much deficient in point of light. Much more light is lost by reflection than by refraction: and as in these telescopes the light must unavoidably suffer two reflections, a great deal of it is lost; nor is this loss counterbalanced by the greater aperture which these telescopes will bear, which enables them to receive a greater quantity of light than the refracting ones. The metals of reflecting telescopes also are very much subject to tarnish, and require much more dexterity to clean them than the glasses of refractors; which makes them more troublesome and expensive, though for making discoveries in the celestial regions they are undoubtedly the only proper instruments which have been hitherto constructed. If Dr Blair indeed shall be so fortunate as to discover a vitreous substance of the same powers with the fluid in the compound object-glass of his telescope (and from his abilities and perseverance we have every thing to hope), a refracting telescope may be constructed superior for every purpose to the best reflector.

### II. The Reflecting Telescope.

The inconveniences arising from the great length of refracting telescopes, before Dollond's discovery, are sufficiently obvious; and these, together with the difficulties occasioned by the different refrangibility of light, induced Sir Isaac Newton to turn his attention to the subject of reflection, and endeavours to realize the ideas of himself and others concerning the possibility of constructing telescopes upon that principle.— The instrument which he contrived is represented, fig. 7. where ABCD is a large tube, open at AD and closed at BC, and of a length at least equal to the distance of the focus from the metallic spherical concave speculum GH placed at the end BC. The rays EG, FH, &c. proceeding from a remote object PR, intersect

273 Newton's telescope.

intersect one another somewhere before they enter the tube, so that EG, $eg$ are those that come from the lower part of the object, and $fh$, FH from its upper part: these rays after falling on the speculum GH, will be reflected, so as to converge and meet in $mn$, where they will form a perfect image of the object.— But as this image cannot be seen by the spectator, they are intercepted by a small plane metallic speculum KK, intersecting the axis at an angle of 45°, by which the rays tending to $mn$ will be reflected towards a hole LL in the side of the tube, and the image of the object will thus be formed in $q$ S; which image will be less distinct, because some of the rays which would otherwise fall on the concave speculum GH, are intercepted by the plane speculum: nevertheless it will appear in a considerable degree distinct, because the aperture AD of the tube, and the speculum GH are large. In the lateral hole LL is fixed a convex lens, whose focus is at S$q$; and therefore this lens will refract the rays that proceed from any point of the image, so as at their exit they will be parallel, and those that proceed from the extreme points S$q$ will converge after refraction, and form an angle at O, where the eye is placed; which will see the image S$q$, as if it were an object, through the lens LL; consequently the object will appear enlarged, inverted, bright, and distinct. In LL lenses of different convexities may be placed, which by being moved nearer to the image or farther from it, would represent the object more or less magnified, provided that the surface of the speculum GH be of a perfectly spherical figure. If, in the room of one lens LL, three lenses be disposed in the same manner with the three eye-glasses of the refracting telescope, the object will appear erect, but less distinct than when it is observed with one lens. On account of the position of the eye in this telescope, it is extremely difficult to direct the instrument towards any object. Huygens, therefore, first thought of adding to it a small refracting telescope, the axis of which is parallel to that of the reflector. This is called a *finder* or *director*. The Newtonian telescope is also furnished with a suitable apparatus for the commodious use of it.

274 Its magnifying power. Plate CCCLXV.

In order to determine the magnifying power of this telescope, it is to be considered that the plane speculum KK is of no use in this respect. Let us then suppose, that one ray proceeding from the object coincides with the axis GLIA (fig. 8.) of the lens and speculum; let $b\,b$ be another ray proceeding from the lower extreme of the object, and passing through the focus I of the speculum KH: this will be reflected in the direction $b\,i\,d$, parallel to the axis GLA, and falling on the lens $d$L$d$, will be refracted to G; so that GL will be equal to LI, and $d$G$=d$I. To the naked eye the object would appear under the angle I$bi$=$b$IA; but by means of the telescope it appears under the angle $d$GL=$d$IL=I$di$: and the angle I$di$ is to the angle I$bi$ : : I$b$ : I$d$; consequently the apparent magnitude by the telescope is to that by the naked eye as the distance of the focus of the speculum from the speculum, to the distance of the focus of the lens from the lens.

The Newtonian telescope was still inconvenient. Notwithstanding the contrivance of Huygens, objects were by it found with difficulty. The telescope of Grego[illegible], therefore, soon obtained the preference, to which [illegible] most purposes it is justly entitled, as the reader w[illegible] perceive from the following construction.

275 Gregorian telescope.

Let T[illegible]T (fig. 9.) be a brass tube, in which L$ld$D is a metall[illegible] concave speculum, perforated in the middle at X; a[illegible] EF a less concave mirror, so fixed by the arm or [illegible]ong wire RT, which is moveable by means of a lo[illegible] screw on the outside of the tube, as to be moved ne[illegible]er to or farther from the larger speculum L$ld$D, [illegible]s axis being kept in the same line with that of the [illegible]eat one. Let AB represent a very remote object fro[illegible] each part of which issue pencils of rays, e. g. $cd$, CD from A the upper extreme of the object, and IL, $il$, f[illegible]m the lower part B; the rays IL, CD from the ext[illegible]mes crossing one another before they enter the t[illegible]e. These rays falling upon the larger mirror LD, ar[illegible] from it into the focus KH, where [illegible] an inverted image of the object AB, [illegible] New[illegible]lescope. From this image the rays, [illegible]ject, fall upon the small mirror E[illegible], the centre [illegible]h is at $e$; so that after reflection they would [illegible] their foci at Q Q, and there form an erect [illegible] But since an eye at that place could see but [illegible]all part of an object, in order to bring rays from more di[illegible]nt parts of it into the pupil, they are intercepted by the plano-convex lens MN, by which means a small[illegible] erect image is formed at PV, which is viewed from the meniscus SS by an eye at O This meniscus bo[illegible]h makes the rays of each pencil parallel and magnifies the image PV. At the place of this image all the foreign rays are intercepted by the perforated partition ZZ. For the same reason the hole near the eye O is very narrow. When nearer objects are viewed by this telescope, the small speculum EF is removed to a greater distance from the larger LD, so that the second image may be always formed in PV; and this distance is to be adjusted (by means of the screw on the outside of the great tube) according to the form of the eye of the spectator. It is also necessary, that the axis of the telescope should pass through the middle of the speculum EF, and its centre, the centre of the speculum LL, and the middle of the hole X, the centres of the lenses MN, SS, and the hole near O. As the hole X in the speculum LL can reflect none of the rays issuing from the object, that part of the image which corresponds to the middle of the object must appear to the observer more dark and confused than the extreme parts of it. Besides, the speculum EF will also intercept many rays proceeding from the object; and therefore unless the aperture TT be large, the object must appear in some degree obscure.

In the best reflecting telescopes, the focus of the small mirror is never coincident with the focus of the great one, where the first image KH is formed, but a little beyond it (with respect to the eye), as at $n$; the consequence of which is, that the rays of the pencils will not be parallel after reflection from the small mirror, but converge so as to meet in points about Q $q$ Q, where they would form a larger upright image than PV, if the glass R was not in their way; and this image might be viewed by means of a single eye-glass properly placed between the image and the eye; but then the field of view would be less, and consequently

Fig. 1.

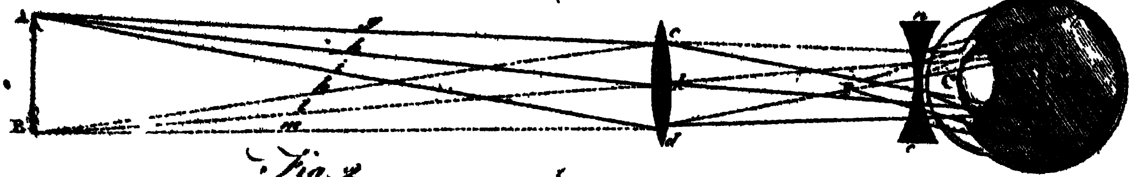


Fig. 2.

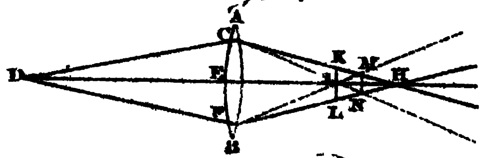


Fig. 3.

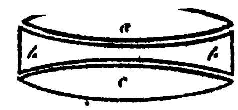


Fig. 4.

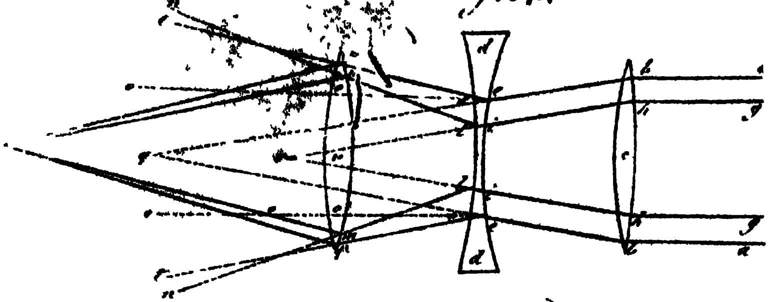


Fig. 8.

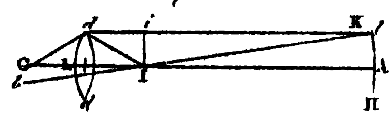


Fig. 5.

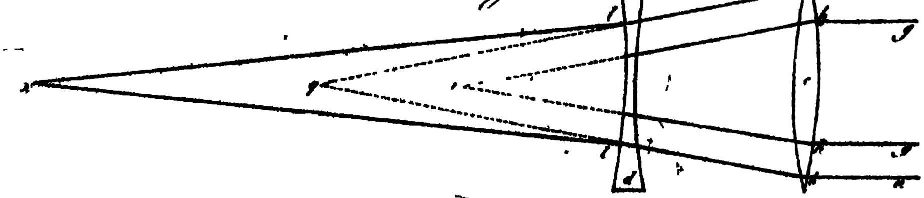


Fig. 6.

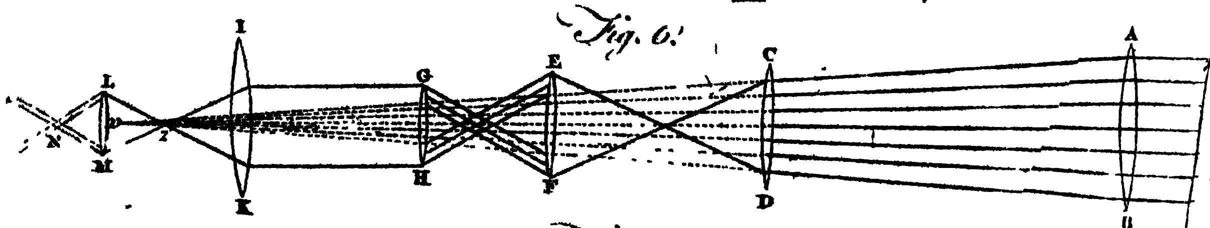


Fig. 7.

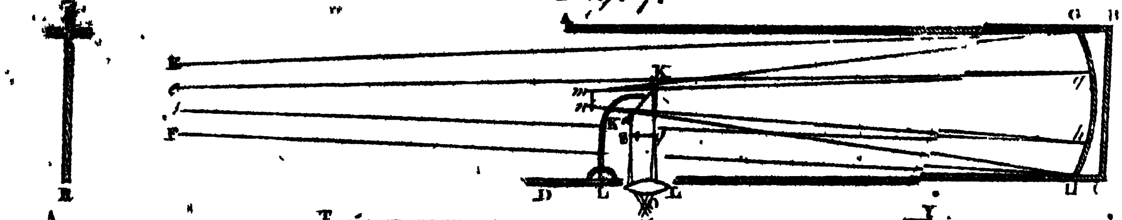
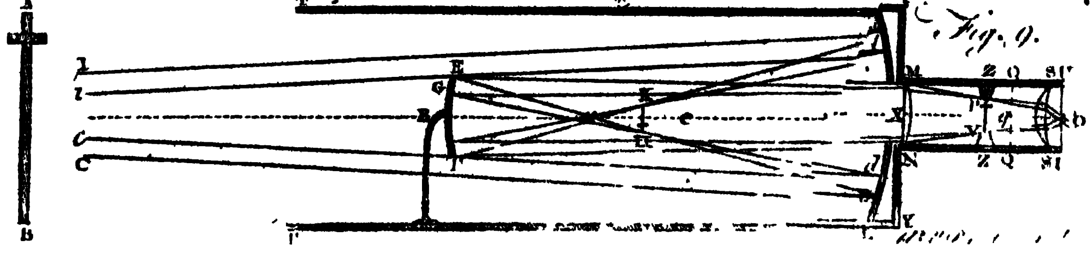
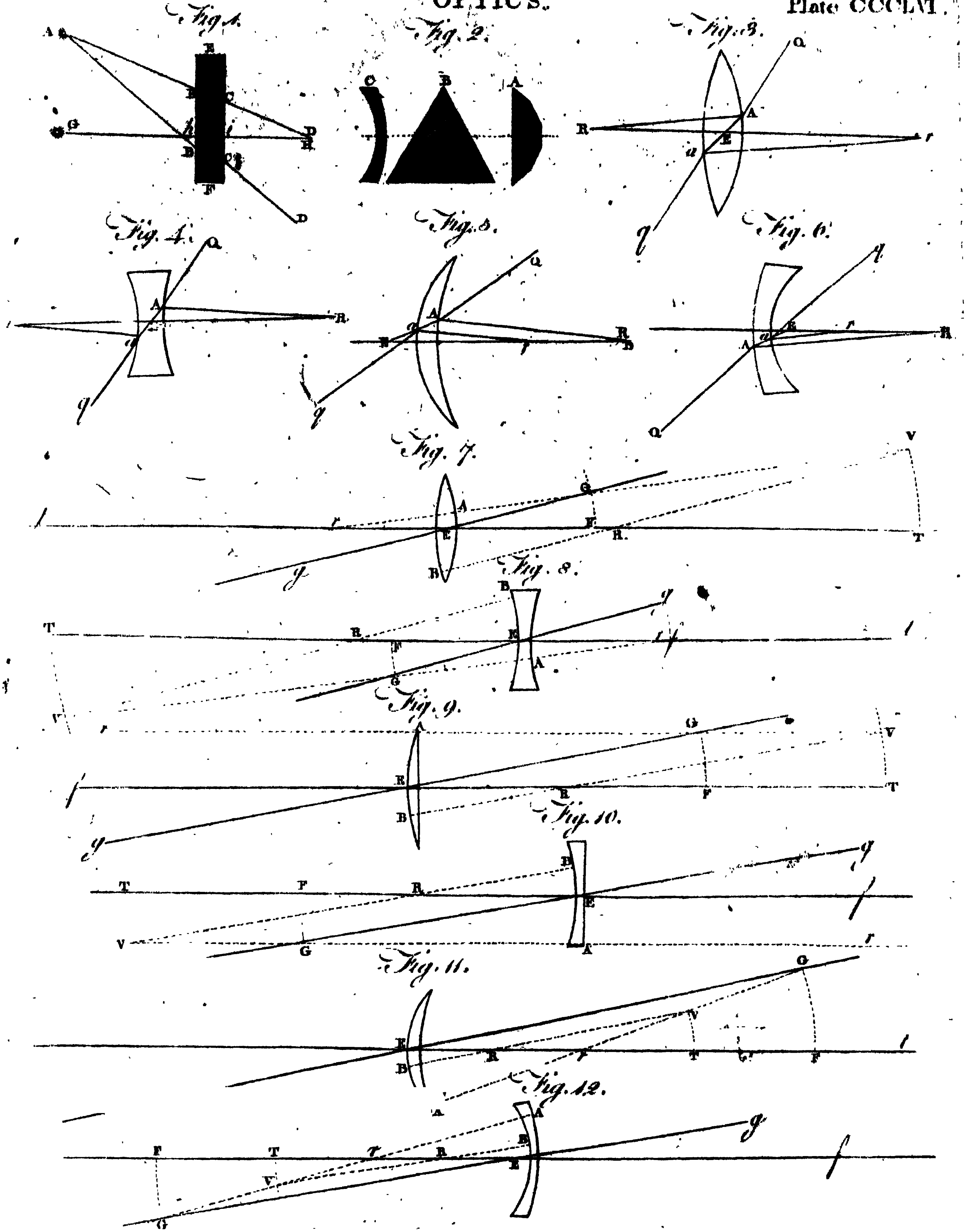


Fig. 9.






A. Bell Prin. Wal. Sculptor fecit.

Reflecting Telescope.

quently not so pleasant; for which reason, the glass R is still retained, to enlarge the scope or area of the field.

276 Its magnifying power.

To find the magnifying power of this telescope, multiply the focal distance of the great mirror by the distance of the small mirror from the image next the eye, and multiply the focal distance of the small mirror by the focal distance of the eye-glass: then divide the product of the former multiplication by the product of the latter, and the quotient will express the magnifying power.

One great advantage of the reflecting telescope is, that it will admit of an eye-glass of a much shorter focal distance than a refracting telescope will; and consequently it will magnify so much the more: for the rays are not coloured by reflection from a concave mirror, if it be ground to a true figure, as they are by passing through a convex glass, let it be ground ever so true.

The nearer an object is to the telescope, the more its pencils of rays will diverge before they fall upon the great mirror, and therefore they will be the longer of meeting in points after reflection; so that the first image KH will be formed at a greater distance from the large mirror, when the object is near the telescope, than when it is very remote. But as this image must be formed farther from the small mirror than its principal focus *n*, this mirror must be always set at a greater distance from the large one, in viewing near objects, than in viewing remote ones. And this is done by turning the screw on the outside of the tube, until the small mirror be so adjusted, that the object (or rather its image) appears perfect.

In looking through any telescope towards an object, we never see the object itself, but only that image of it which is formed next the eye in the telescope. For if a man holds his finger or a stick between his bare eye and an object, it will hide part (if not the whole) of the object from his view: But if he ties a stick across the mouth of a telescope before the object-glass, it will hide no part of the imaginary object he saw through the telescope before, unless it covers the whole mouth of the tube: for all the effect will be, to make the object appear dimmer, because it intercepts part of the rays. Whereas, if he puts only a piece of wire across the inside of the tube, between the eye-glass and his eye, it will hide part of the object which he thinks he sees; which proves, that he sees not the real object, but its image. This is also confirmed by means of the small mirror EF, in the reflecting telescope, which is made of opaque metal, and stands directly between the eye and the object towards which the telescope is turned; and will hide the whole object from the eye at O, if the two glasses ZZ and SS are taken out of the tube.

Great improvements have been lately made in the construction of both reflecting and refracting telescopes, as well as in the method of applying those instruments to the purposes for which they are intended. These, however, fall not properly under the science of optics, as fitter opportunities occur of giving a full account of them, as well as of the magic lantern, camera obscura, &c. under other articles of our multifarious work. See CATOPTRICS, DIOPTRICS, SPECULUM, and TELESCOPE. We shall conclude this article with some observations

Microscopes and Telescopes compared.

*On the different Merits of Microscopes and Telescopes, compared with one another; how far we may reasonably depend on the Discoveries made by them, and what hopes we may entertain of further Improvements.*

277 Merits of microscopes and telescopes compared.

The advantages arising from the use of microscopes and telescopes depend, in the first place, upon their property of magnifying the minute parts of objects, so that they can by that means be more distinctly viewed by the eye; and, secondly, upon their throwing more light into the pupil of the eye than what is done without them. The advantages arising from the magnifying power would be extremely limited, if they were not also accompanied by the latter: for if the same quantity of light is spread over a large portion of surface, it becomes proportionably diminished in force; and therefore the objects, though magnified, appear proportionably dim. Thus, though any magnifying glass should enlarge the diameter of the object 10 times, and consequently magnify the surface 100 times, yet if the focal distance of the glass was about eight inches (provided this was possible), and its diameter only about the size of the pupil of the eye, the object would appear 100 times more dim when we looked through the glass, than when we beheld it with our naked eyes; and this, even on a supposition that the glass transmitted all the light which fell upon it, which no glass can do. But if the focal distance of the glass was only four inches, though its diameter remained as before, the inconvenience would be vastly diminished, because the glass could then be placed twice as near the object as before, and consequently would receive four times as many rays as in the former case, and therefore we would see it much brighter than before. Going on thus, still diminishing the focal distance of the glass, and keeping its diameter as large as possible, we will perceive the object more and more magnified, and at the same time very distinct and bright. It is evident, however, that with regard to optical instruments of the microscopic kind, we must sooner or later arrive at a limit which cannot be passed. This limit is formed by the following particulars. 1. The quantity of light lost in passing through the glass. 2. The diminution of the glass itself, by which it receives only a small quantity of rays. 3. The extreme shortness of the focal distance of great magnifiers, whereby the free access of the light to the object which we wish to view is impeded, and consequently the reflection of the light from it is weakened. 4. The aberrations of the rays, occasioned by their different refrangibility.

To understand this more fully, as well as to see how far these obstacles can be removed, let us suppose the lens made of such a dull kind of glass that it transmits only one half of the light which falls upon it. It is evident that such a glass, of four inches focal distance, and which magnifies the diameter of an object twice, still supposing its own breadth equal to that of the pupil of the eye, will show it four times magnified in surface, but only half as bright as if it was seen by the naked eye at the usual distance; for the light which falls upon the eye from the object at eight inches distance, and likewise the surface of the object in its

Microscopes and Telescopes compared.

natural size, being both represented by 1, the surface of the magnified object will be 4, and the light which makes that magnified object visible only 2; because though the glass receives four times as much light as the naked eye does at the usual distance of distinct vision, yet one half is lost in passing through the glass. The inconvenience in this respect can therefore be removed only as far as it is possible to increase the clearness of the glass, so that it shall transmit nearly all the rays which fall upon it; and how far this can be done, hath not yet been ascertained.

The second obstacle to the perfection of microscopic glasses is the small size of great magnifiers, by which, notwithstanding their near approach to the object, they receive a smaller quantity of rays than might be expected. Thus, suppose a glass of only $\frac{1}{10}$th of an inch focal distance; such a glass would increase the visible diameter 80 times, and the surface 6400 times. If the breadth of the glass could at the same time be preserved as great as that of the pupil of the eye, which we shall suppose $\frac{2}{10}$ths of an inch, the object would appear magnified 6400 times, at the same time that every part of it would be as bright as it appears to the naked eye. But if we suppose that this magnifying glass is only $\frac{1}{10}$th of an inch in diameter, it will then only receive $\frac{1}{4}$th of the light which otherwise would have fallen upon it; and therefore, instead of communicating to the magnified object a quantity of illumination equal to 6400, it would communicate only one equal to 1600, and the magnified object would appear four times as dim as it does to the naked eye. This inconvenience, however, is still capable of being removed, not indeed by increasing the diameter of the lens, because this must be in proportion to its focal distance, but by throwing a greater quantity of light on the object. Thus, in the above-mentioned example, if four times the quantity of light which naturally falls upon it could be thrown upon the object, it is plain that the reflection from it would be four times as great as in the natural way; and consequently the magnified image, at the same time that it was as many times magnified as before, would be as bright as when seen by the naked eye. In transparent objects this can be done very effectually by a concave speculum, as in the reflecting microscope already described: but in opaque objects the case is somewhat more doubtful; neither do the contrivances for viewing these objects seem entirely to make up for the deficiencies of the light from the smallness of the lens and shortness of the focus.—When a microscopic lens magnifies the diameter of an object forty times, it hath then the utmost possible magnifying power, without diminishing the natural brightness of the object.

The third obstacle arises from the shortness of the focal distance in large magnifiers: but in transparent objects, where a sufficient quantity of light is thrown on the object from below, the inconvenience arises at last from straining the eye, which must be placed nearer the glass than it can well bear; and this entirely supersedes the use of magnifiers beyond a certain degree.

The fourth obstacle arises from the different refrangibility of the rays of light, and which frequently causes such a deviation from truth in the appearances of things, that many people have imagined themselves to have made surprising discoveries, and have even published them to the world; when in fact they have been only as many optical deceptions, owing to the unequal refractions of the rays. For this there seems to be no remedy, except the introduction of achromatic glasses into microscopes as well as telescopes. How far this is practicable, hath not yet been tried; but when these glasses shall be introduced (if such introduction is practicable), microscopes will then undoubtedly have received their ultimate degree of perfection.

278 Dollond's and Blair's refracting telescopes superior to all others.

With regard to telescopes, those of the refracting kind have evidently the advantage of all others, where the aperture is equal, and the aberrations of the rays are corrected according to Mr Dollond's method; because the image is not only more perfect, but a much greater quantity of light is transmitted than what can be reflected from the best specula hitherto known. Unluckily, however, the imperfections of the glass set a limit to these telescopes, which have already been observed, so that they cannot be made above three feet and a half long. On the whole, therefore, the reflecting telescopes are preferable in this respect, that they may be made of dimensions greatly superior; by which means they can both magnify to a greater degree, and at the same time throw much more light into the eye.

With regard to the powers of telescopes, however, they are all of them exceedingly less than what we would be apt to imagine from the number of times which they magnify the object. Thus, when we hear of a telescope which magnifies 200 times, we are apt to imagine, that, on looking at any distant object through it, we should perceive it as distinctly as we would with our naked eye at the 200th part of the distance. But this is by no means the case; neither is there any theory capable of directing us in this matter: we must therefore depend entirely on experience.

The best method of trying the goodness of any telescope is by observing how much farther off you are able to read with it than you can with the naked eye. But that all deception may be avoided, it is proper to choose something to be read where the imagination cannot give any assistance, such as a table of logarithms, or something which consists entirely of figures; and hence the truly useful power of the telescope is easily known. In this way Mr Short's large telescope, which magnifies the diameter of objects 1200 times, is yet unable to afford sufficient light for reading at more than 200 times the distance at which we can read with our naked eye.

279 The Gregorian telescope superior for common use to the Newtonian.

With regard to the form of reflecting telescopes, it is now pretty generally agreed, that when the Gregorian ones are well constructed, they have the advantage of those of the Newtonian form. One advantage evident at first sight is, that with the Gregorian telescope an object is perceived by looking directly through it, and consequently is found with much greater ease than in the Newtonian telescope, where we must look into the side. The unavoidable imperfection of the specula common to both, also gives the Gregorian an advantage over the Newtonian form. Notwithstanding the utmost care and labour of the workmen, it is found impossible to give the metals either a perfectly spherical or a perfectly parabolical form. Hence arises some

Micro-ſcopes and Teleſcopes compared.

ſome indiſtinctneſs of the image formed by the great ſpeculum, which is frequently corrected by the little one, provided they are properly matched. But if this is not done, the error will be made much worſe; and hence many of the Gregorian teleſcopes are far inferior to the Newtonian ones; namely, when the ſpecula have not been properly adapted to each other. There is no method by which the workman can know the ſpecula which will fit one another without a trial; and therefore there is a neceſſity for having many ſpecula ready made of each ſort, that in fitting up a teleſcope thoſe may be choſen which beſt ſuit each other.

The brightneſs of any object ſeen through a teleſcope, in compariſon with its brightneſs when ſeen by the naked eye, may in all caſes be eaſily found by the following formula. Let *n* repreſent the natural diſtance of a viſible object, at which it can be diſtinctly ſeen; and let *d* repreſent its diſtance from the object-glaſs of the inſtrument. Let *m* be the magnifying power of the inſtrument; that is, let the viſual angle ſubtended at the eye by the object when at the diſtance *n*, and viewed without the inſtrument, be to the viſual angle produced by the inſtrument as 1 to *m*. Let *a* be the diameter of the object-glaſs, and *p* be that of the pupil. Let the inſtrument be ſo conſtructed, that no parts of the pencils are intercepted for want of ſufficient apertures of the intermediate glaſſes. Laſtly, Let the light loſt in reflection or refraction be neglected.

The brightneſs of viſion through the inſtrument will be expreſſed by the fraction $\frac{a^2 n}{m p^2 d}$, the brightneſs of natural viſion being 1. But although this fraction may exceed unity, the viſon through the inſtrument will not be brighter than natural viſion. For, when this is the caſe, the pupil does not receive all the light tranſmitted through the inſtrument.

In microſcopes, *n* is the neareſt limits of diſtinct viſion, nearly 8 inches. But a difference in this circumſtance, ariſing from a difference in the eye, makes no change in the formula, becauſe *m* changes in the ſame proportion with *n*.

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Optimates, Optio.

OPTIMATES, one of the divisions of the Roman people opposed to *populares*. It is not easy to ascertain the characteristic differences betwixt these two parties. Some say the optimates were warm supporters of the dignity of the chief magistrate, and promoters of the grandeur of the state, who cared not if the inferior members suffered, provided the commanding powers were advanced: Whereas the populares boldly stood up for the rights of the people, pleaded for larger privileges, and laboured to bring matters nearer to a level. In short, they resembled, according to this account, the court and country parties amongst the people of this island.

Tully says, that the optimates were the best citizens, who wished to deserve the approbation of the better sort; and that the populares courted the favour of the populace, not so much considering what was right, as what would please the people and gratify their own thirst of vain glory and empty applause.

OPTIO, an officer in the Roman army, being an assistant or lieutenant to every centurion. The *optio* was so called because he was the choice or option of the centurion in later times; at first, however, he had been chosen by the tribune, or chief commander of the legion. These *optiones* are also sometimes called *succenturiones* and *tergiductores;* the last name was given them because their post was in the rear of the company. Some authors make mention of *sub-optiones* or sub-lieutenants.

Optio, Opuntia.

It is proper, however, to add, that optiones were not peculiar to the camp, but were also used in a variety of other offices of life.

OPTION, the power or faculty of wishing, or choosing; or the choice a person makes of any thing.

When a new suffragan bishop is consecrated, the archbishop of the province, by a customary prerogative, claims the collation of the first vacant benefice, or dignity, in that see, according as he shall choose; which choice is called the archbishop's *option*.

But in case the bishop dies, or is translated, before the present incumbent of the promotion chosen by the archbishop shall die or be removed, it is generally supposed that the option is void; inasmuch as the granter, singly and by himself, could not convey any right or title beyond the term of his continuance in that see. And if the archbishop dies before the avoidance shall happen, the right of filling up the vacancy shall go to his executors or administrators.

OPUNTIA, a species of cactus; see Cactus. The fruit of the opuntia is remarkable for colouring the juices of living animals, though it appears not to be poisonous or even hurtful to the body. In a letter from Charlestown in South Carolina, which was published in the 50th volume of the Philosophical Transactions, the author writes thus:—"As you desired, I tried the effects of the prickly pear in clearing the urine. A few days after your letter, I went down to one of the islands, and gathered some of the fruit,

and gave four of the pears to a child of three years of age, and six pears to one of five. The next morning I examined the urine of both, and it appeared of a very lively red colour, as if tart wine had been mixed with water. I gave likewise six pears to a negro wench, who was suckling an infant, and strictly forbade her to put the child to her breast for six or eight hours; and then taking some of her milk in a teacup, and setting it by for some hours, the cream had a reddish lustre, though it was very faint." From the same letter we learn, that the prickly pear grows in great abundance about Carolina; and also that the cochineal insects are found upon it, though no attempt, that we know of, has hitherto been made to cure them for use as the Spaniards do.

OR, the French word for gold, by which this metal is expressed in heraldry. In engraving it is denoted by small points all over the field or bearing. It may be supposed to signify of itself, *generosity*, *splendour*, or *solidity*; according to G. Leigh, if it is compounded with

| | | |
|---|---|---|
| Gul. | it signifies | Courage. |
| Azu. | | Trust. |
| Vor. | | Joy. |
| Pur. | | Charity. |
| Sab. | | Constancy. |

ORA, in antiquity, was a term equivalent to an ounce; but it has been much debated among our antiquaries, whether the ora, the mention of which so often occurs, was a coin, or only money of account. Dr Hickes observes, that the mode of reckoning money by marks and oras was never known in England till after the Danish settlements; and by examining the old nummulary estimates among the principal Gothic states upon the Baltic, it appears, that the ora and solidus were synonymous terms, and that the ora was the eighth part of the mark. From several of the Danish laws, it likewise appears, that the Danish ora, derived by corruption from *aureus*, was the same as the Frank solidus of twelve pence. As a weight, the ora was regarded as the uncia or unit, by which the Danish mark was divided; and in Doomsday book the ora is used for the ounce, or the twelfth part of the nummulary Saxon pound, and the fifteenth of the commercial: as a coin, it was an aureus, or the Frank solidus of twelve pence. And from the accidental coincidence of the Frank aureus with the eighth part of their mark, the Danes probably took occasion to give it the new name of *ora*. There was another ora mentioned in the rolls of the 27th of Henry III. the value of which was sixteen pence; and this was probably derived from the half marcus of the Saxons. Such, in all appearance, was the original of these two oras; as there were no aurei of that period, to which these two denominations of money of sixteen and twelve pence can possibly be ascribed. It is observed farther, that the name *ora* distinguishes the gold coins in several parts of Europe to this day. The Portuguese moidore is nothing else but *moeda d'oro*, from the Latin *moneta de auro*; the French *Louis d'ores* come from the same use of the word, and owe their appellation to the ora. See Clarke on Coins.

ORACH. See ATRIPLEX.

*Wild* ORACH. See CHENOPODIUM.



ORACLE, among the heathens, was the answer which the gods were supposed to give to those who consulted them upon any affair of importance. It is also used for the god who was thought to give the answer, and for the place where it was given.

The credit of oracles was so great, that in all doubts and disputes their determinations were held sacred and inviolable: whence vast numbers flocked to them for advice about the management of their affairs; and no business of any consequence was undertaken, scarce any peace concluded, any war waged, or any new form of government instituted, without the advice and approbation of some oracle. The answers were usually given by the intervention of the priest or priestess of the god who was consulted; and generally expressed in such dark and unintelligible phrases, as might be easily wrested to prove the truth of the oracle whatever was the event. It is not, therefore, to be wondered at, that the priests who delivered them were in the highest credit and esteem, and that they managed this reputation so as greatly to promote their own particular advantage. They accordingly allowed no man to consult the gods, before he had offered costly sacrifices, and made rich presents to them. And to keep up the veneration for their oracles, and to prevent their being taken unprepared, they admitted persons to consult the gods only at certain stated times; and sometimes they were so cautious, that the greatest personages could obtain no answer at all. Thus Alexander himself was peremptorily denied by the Pythia, or priestess of Apollo, till she was by downright force obliged to ascend the tripos; when, being unable to resist any longer, she cried out, *Thou art invincible:* and these words were accepted instead of a farther oracle.

Of the ambiguity of oracles, the following, out of a great many examples, may be mentioned. Crœsus having received from the Pythoness this answer, That by passing the river Halys, he would destroy a great empire; he understood it to be the empire of his enemy, whereas he destroyed his own.—The oracle consulted by Pyrrhus gave him an answer, which might be equally understood of the victory of Pyrrhus, and the victory of the Romans his enemies:

*Aio te, Æacida, Romanos vincere posse.*

The equivocation lies in the construction of the Latin tongue, which cannot be rendered in English.—The Pythoness advised Crœsus to guard against the mule. The king of Lydia understood nothing of the oracle, which denoted Cyrus descended from two different nations; from the Medes, by Mandana his mother, the daughter of Astyages; and from the Persians, by his father Cambyses, whose race was by far less grand and illustrious.—Nero had for answer, from the oracle of Delphos, that seventy-three might prove fatal to him. He believed he was safe from all danger till that age; but, finding himself deserted by every one, and hearing Galba proclaimed emperor, who was 73 years of age, he was sensible of the deceit of the oracle.

When men began to be better instructed by the lights philosophy had introduced into the world, the false oracles insensibly lost their credit. Chrysippus filled an entire volume with false or doubtful oracles. Oenomaus, to be revenged of some oracle that had deceived him, made a compilation of oracles, to show their

Oracle. their ridiculous vanity. Eusebius has preserved some fragments of this criticism on oracles by Oenomaus. "I might (says Origen) have recourse to the authority of Aristotle and the Peripatetics, to make the Pythoness much suspected; I might extract from the writings of Epicurus and his sectators an abundance of things to discredit oracles; and I might show that the Greeks themselves made no great account of them."

The reputation of oracles was greatly lessened when they became an artifice of politics. Themistocles, with a design of engaging the Athenians to quit Athens, and to embark, in order to be in a better condition to resist Xerxes, made the Pythoness deliver an oracle, commanding them to take refuge in wooden walls. Demosthenes said, that the Pythoness *Philippized;* to signify that she was gained over by Philip's presents.

The cessation of oracles is attested by several profane authors; as Strabo, Juvenal, Lucan, and others. Plutarch accounts for it, by saying, that the benefits of the gods are not eternal as themselves are; or that the genii, who presided over oracles, are subject to death; or that the exhalations of the earth had been exhausted. It appears that the last reason had been alleged in the time of Cicero, who ridicules it in his second book of Divination, as if the spirit of prophecy, supposed to be excited by subterraneous effluvia, had evaporated by length of time, as wine or pickle by being long kept.

Suidas, Nicephorus, and Cedrenus, relate, that Augustus, having consulted the oracle of Delphos, could obtain no other answer but this: "The Hebrew child whom all the gods obey, drives me hence, and sends me back to hell: get out of this temple without speaking one word." Suidas adds, that Augustus dedicated an altar in the Capitol, with this inscription, "To the eldest Son of God." Notwithstanding these testimonies, the answer of the oracle of Delphos to Augustus seems very suspicious. Cedrenus cites Eusebius for this oracle, which is not now found in his works; and Augustus's peregrination into Greece was 18 years before the birth of Christ.

Suidas and Cedrenus give an account also of an ancient oracle delivered to Thulis, a king of Egypt, which they say is well authenticated. The king having consulted the oracle of Serapis, to know if there ever was, or would be, one so great as himself, received this answer: First, God, next the Word, and the Spirit with them. They are equally eternal, and make but one whose power will never end. But thou, mortal, go hence, and think that the end of the life of man is uncertain."

Van Dale, in his treatise of oracles, does not believe that they ceased at the coming of Christ. He relates several examples of oracles consulted till the death of Theodosius the Great. He quotes the laws of the emperors Theodosius, Gratian, and Valentinian, against those who consulted oracles, as a certain proof that the superstition of oracles still subsisted in the time of those emperors.

According to others, the opinion of those who believe that demons had no share in the oracles, and that the coming of the Messiah made no change in them, and the contrary opinion of those who pretend that the incarnation of the Word imposed a general silence on all oracles, should be equally rejected. They allege, that two sorts of oracles ought to be distinguished: the one dictated by the spirits of darkness, who deceived men by their obscure and doubtful answers; the other, the pure artifice and cheat of the priests of false divinities. As to the oracles given out by demons, the reign of Satan was destroyed by the coming of the Saviour; truth shut the mouth of lies; but Satan continued his old craft among idolaters. All the devils were not forced to silence at the same time by the coming of the Messiah; it was on particular occasions that the truth of Christianity, and the virtue of Christians, imposed silence on the devils. St Athanasius tells the Pagans, that they have been witnesses themselves that the sign of the cross puts the devils to flight, silences oracles, and dissipates enchantments. This power of silencing oracles, and putting the devils to flight, is also attested by Arnobius, Lactantius, Prudentius, Minutius Felix, and several others. Their testimony is a certain proof that the coming of the Messiah had not imposed a general silence on oracles.

Plutarch relates, that the pilot Thamus heard a voice in the air, crying out, "The great Pan is dead;" whereupon Eusebius observes, that the accounts of the death of the demons were frequent in the reign of Tiberius, when Christ drove out the wicked spirits.

The same judgment, it is said, may [illegible] on oracles as on *possessions.* It was on [illegible] sions, by the divine permission, that the [illegible] out devils, or silenced oracles, in the presence, and even by the confession, of the Pagans themselves. And thus it is we should, it seems, understand the passages of St Jerome, Eusebius, Cyril, Theodoret, Prudentius, and other authors, who said that the coming of Christ had imposed silence on the oracles.

As to the second sort of oracles, which were pure artifices and cheats of the priests of false divinities, and which probably exceeded the number of those that immediately proceeded from demons, they did not cease till idolatry was abolished, though they had lost their credit for a considerable time before the coming of Christ. It was concerning this more common and general sort of oracles that Minutius Felix said, they began to discontinue their responses, according as men began to be more polite. But, however oracles were decried, impostors always found dupes, the grossest cheats having never failed.

Daniel discovered the imposture of the priests of Bel, who had a private way of getting into the temple to take away the offered meats, and who made the king believe that the idol consumed them.—Mundus, being in love with Paulina, the eldest of the priestesses of Isis, went and told her, that the god Anubis, being passionately fond of her, commanded her to give him a meeting. She was afterwards shut up in a dark room, where her lover Mundus, whom she believed to be the god Anubis, was concealed. This imposture having been discovered, Tiberius ordered those detestable priests and priestesses to be crucified, and with them Idea, Mundus's free woman, who had conducted the whole intrigue. He also commanded the

the temple of Isis to be levelled with the ground, and her statue to be thrown into the Tiber; and, as to Mundus, he contented himself with sending him into banishment.

Theophilus, bishop of Alexandria, not only destroyed the temples of the false gods, but discovered the cheats of the priests, by showing that the statues, some of which were of brass, and others of wood, were hollow within, and led into dark passages made in the wall.

Lucian, in discovering the impostures of the false prophet Alexander, says, that the oracles were chiefly afraid of the subtilties of the Epicureans and Christians. The false prophet Alexander sometimes feigned himself seized with a divine fury, and by means of the herb sopewort, which he chewed, frothed at the mouth in so extraordinary a manner, that the ignorant people attributed it to the strength of the god he was possessed by. He had long before prepared a head of a dragon made of linen, which opened and shut its mouth by means of a horse hair. He went by night to a place where the foundations of a temple were digging: and having found water, either of a spring, or rain that had settled there, he hid in it a goose egg, in which he had enclosed a little serpent that had been just hatched. The next day, very early in the morning, he came quite naked into the street, having only a scarf about his middle, holding in his hand a scythe, and tossing about his hair as the priests of Cybele; then getting a-top of a high altar, he said, that the place was happy to be honoured by the birth of a god. Afterwards, running down to the place where he had hid the goose egg, and going into the water, he began to sing the praises of Apollo and Æsculapius, and to invite the latter to come and show himself to men. With these words, he dips a bowl into the water, and takes out the [illegible] egg, which had a god enclosed in it; and when he had it in his hand, he began to say that he held Æsculapius. Whilst all were eager to have a sight of this fine mystery, he broke the egg, and the little serpent starting out, twisted itself about his fingers.

These examples show clearly, that both Christians and Pagans were so far agreed as to treat the *greater number* of oracles as purely human impostures. That, in fact, ALL of them were so, will be concluded by those who give equal credit to demoniacal *inspiration*, and demoniacal *possession*. The most ancient oracle was that of Dodona (see DODONA); but the most famous was that of Delphi, to which article we also refer for further particulars on this subject, so famous in Pagan antiquity. Another celebrated one was the oracle of Trophonius, in the neighbourhood of Lebadia, a city of Bœotia, which was held in high estimation. It received its name from Trophonius, brother of Agamedes, who lived in a subterraneous dwelling near Lebadia, and pretended to the faculty of foretelling future events. He died in his cave, and was deified as an oracular god. This oracle owed its reputation to one Saon.

Those who repaired to this cave for information, were required to offer certain sacrifices, to anoint themselves with oil, and to bathe in a certain river: They were then clothed in a linen robe, took a honeyed cake in their hands, and descended into the subterraneous chamber by a narrow passage. Here it was that futurity was unfolded to them, either by visions or extraordinary sounds. The return from the cave was by the same passage, but the persons consulting were obliged to walk backwards. They generally came out astonished, melancholy, and dejected; hence the proverb εις Τροφωνιου μεμαντευται. The priests on their return placed them on an elevated seat, called *the seat of Mnemosyne*, where an account was taken of what they had seen and heard. They were then conducted to the chapel of good Genius by their companions, where, by degrees, they recovered their usual composure and cheerfulness.

Besides these three principal oracles of Greece, it is proper to take notice of that of Amphiaraus at Oropius in Attica. It was so called from Amphiaraus, the son of Oicleus, a man skilled in magic, the interpretation of dreams, &c. and who after his death was deified and delivered oracles in a temple erected to his divinity. (See AMPHIARAUS.) They who applied to him for information, were to purify themselves, offer sacrifice, fast twenty-four hours, abstain from wine two days, and make an offering of a ram to Amphiaraus; on the skin of which they were to sleep, and see their destiny in a dream. Near the temple was Amphiaraus's fountain, which was sacred, and the waters of it forbidden to be used for ordinary purposes.

At Delos also there was an oracle of the Delian Apollo: in Milesia was that of the Branchidæ, with others of less note, which require not a particular description, such as that of the camps at Lacedæmon, that of Nabarcha, that of Chrysopolis, that of Claros in Ionia, that of Mallos, that of Patarea, that of Pella, that of Phasellides, that of Sinope, that of Orpheus's head, &c.

Though the Romans consulted the Grecian oracles upon many occasions, and had few oracles in their own country; yet we must not omit mentioning the Cumæan oracles, which were delivered by the Sibyl of Cumæ. For an account of the Sibyls, See the article SIBYL. See also DÆMON and DÆMONIAC.

We have hitherto only considered the oracles of false gods, of which there was a far greater number than our limits permit us to observe, and before either Greeks or Romans had risen to any distinction. Oracle is in sacred history sometimes used for the mercy seat, or the cover of the ark of the covenant; and by others it is taken for the sanctuary, or for the most holy place, wherein the ark was deposited.

Among the Jews we may distinguish several sorts of *real* oracles. They had first oracles that were delivered *viva voce*; as when God spake to Moses face to face, and as one friend speaks to another, (Numb. xii. 8.) Secondly, Prophetical dreams sent by God; as the dreams which God sent to Joseph, and which foretold his future greatness. (Gen. xxxvii. 5, 6.) Thirdly, Visions; as when a prophet in an ecstasy, being neither properly asleep nor awake, had supernatural revelations, (Gen. xv. 1. xlvi. 2.) Fourthly, The oracle of Urim and Thummim, which was accompanied with the ephod or the pectoral worn by the high priest, and which God had endued with the gift of foretelling things.

things to come, (Numb. xii. 6. Joel ii. 28.). This manner of inquiring of the Lord was often made use of, from Joshua's time to the erection of the temple at Jerusalem. Fifthly, After the building of the temple, they generally consulted the prophets, who were frequent in the kingdoms of Judah and Israel. From Haggai, Zechariah, and Malachi, who are the last of the prophets that have any of their writings remaining, the Jews pretend that God gave them what they call *Bathcol*, the daughter of the voice, which was a supernatural manifestation of the will of God, which was performed either by a strong inspiration or internal voice, or else by a sensible and external voice, which was heard by a number of persons sufficient to bear testimony of it. For example, such was the voice that was heard at the baptism of Jesus Christ, saying, This is my beloved Son, &c. (Matth. iii. 17.)

The Scripture affords us examples likewise of profane oracles. Balaam, at the instigation of his own spirit, and urged on by his avarice, fearing to lose the recompense that he was promised by Balak king of the Moabites, suggests a diabolical expedient to this prince, of making the Israelites fall into idolatry and fornication (Numb. xxiv. 14. xxxi. 16.), by which he assures him of a certain victory, or at least of considerable advantage against the people of God.

Micaiah the son of Imlah, a prophet of the Lord, says (1 Kings xxii. 21, &c.), that he saw the Almighty sitting upon his throne, and all the host of heaven round about him; and the Lord said, who shall tempt Ahab king of Israel, that he may go to war with Ramoth-gilead, and fall in the battle? One answered after one manner, and another in another. At the same time an evil spirit presented himself before the Lord and said, I will seduce him. And the Lord asked him, How? To which Satan answered, I will go and be a lying spirit in the mouth of his prophets. And the Lord said, Go and thou shalt prevail. This dialogue clearly proves these two things, *first*, that the devil could do nothing by his own power; and, *secondly*, that with the permission of God, he could inspire the false prophets, sorcerers, and magicians, and make them deliver false oracles.

Respecting the cessation of profane oracles there have been a variety of opinions; some of which we have already remarked. It has been generally held, indeed, that oracles ceased at the birth of Jesus Christ: Yet some have endeavoured to maintain the contrary, by showing that they were in being in the days of Julian, commonly called *the Apostate*, and that this emperor himself consulted them; nay, farther, say they, history makes mention of several laws published by the Christian emperors Theodosius, Gratian, and Valentinian, to punish persons who interrogated them, even in their days; and that the Epicureans were the first who made a jest of this superstition, and exposed the roguery of its priests to the people. As we suspect most of the facts here asserted should be understood in a qualified sense, we shall endeavour to discuss this point of controversy in as few words as possible, although it is undoubtedly a matter of some consequence.

*1st*, The question, properly stated, is not, Whether oracles became extinct *immediately upon the birth of Christ*, or from the very moment he was born? but, If they fell gradually into disesteem and ceased, as Christ and his gospel became known to mankind? And that they did so, is most certain from the concurrent testimonies of the fathers, which, whoever would endeavour to invalidate, may equally give up the most respectable traditions and relations of every kind.

*2dly*, But did not Julian the apostate consult these oracles? We answer in the negative: he had indeed recourse to magical operations, but it was because oracles had already ceased; for he bewailed the loss of them, and assigned pitiful reasons for it; which St Cyril has vigorously refuted, adding, that *he never could have offered such, but from an unwillingness to acknowledge, that when the world had received the light of Christ, the dominion of the devil was at an end.*

*3dly*, The Christian emperors do indeed seem to condemn the superstition and idolatry of those who were still for consulting oracles; but the edicts of those princes do not prove that oracles actually existed in their times, any more than that they ceased in consequence of their laws. It is certain that they were for the most part extinct before the conversion of Constantine.

*4thly*, Some Epicureans might *make a jest of this superstition*: however the Epicurean philosopher Celsus, in the second century of the church, was for crying up the excellency of several oracles, as appears at large from Origen's seventh book against him.

ORÆA, certain solemn sacrifices of fruits which were offered in the four seasons of the year, in order to obtain mild and temperate weather. They were offered to the goddesses who presided over the seasons, who attended upon the sun, and who received divine worship at Athens.

ORAL, something delivered by word of mouth, without being committed to writing; in which sense we say oral law, oral tradition, &c.

ORAN, a very strong and important town of Africa, in Barbary, and in the kingdom of Tremecen, with several forts, and an excellent harbour. It is seated partly on the side of a hill, and partly on a plain, about a stonecast from the sea, almost opposite to Carthagena in Spain. It is about a mile and a half in circumference, and well fortified, but commanded by the adjacent hills. It was taken by the Spaniards in 1509, and retaken by the Algerines in 1708; but in 1732 the Spaniards became masters it, and have continued so ever since. E. Long. 0. 8. N. Lat. 36. 2.

ORANG OUTANG. See SIMIA. Also COMPARATIVE ANATOMY, p. 250. Ch. I. sect. 2.

ORANGE, a famous city, and capital of a province of the same name, united to Dauphiny, with a university and a bishop's see, suffragan of Arles. It is seated in a fine large plain, watered by a vast number of little rivulets on the east side of the river Rhone. It is a very large ancient place, and was considerable in the time of the Romans, who adorned it with several buildings of which there are still some ruins left, particularly of an amphitheatre, and a triumphal arch, which is almost entire, dedicated to Marius. This town was formerly much larger than it is at present, as appears from the traces of the ancient walls. The wall was in 1682 entirely demolished by order of Louis XIV. and the inhabitants were exposed to the fury of the soldiers. The town was restored to King William by the treaty of Ryswick; but after his death

Orange

death the French took it again, and expelled the Protestant inhabitants. By the treaty of Utrecht it was confirmed to the crown of France, though the title is still retained in the house of Nassau. The title was first introduced into the family of Nassau, by the marriage of Claude de Chalons, the prince of Orange's sister, with the count of Nassau, 1530. The principality is a very small district, it being only twelve miles in length and nine in breadth, and the revenue amounts to about 5000l. a-year. The country is pleasant, and abounds with corn and fruit, but is exposed to violent winds. E. Long. 4. 49. N. Lat. 44. 9.

*Maurice Prince of* ORANGE. See MAURICE.

ORANGE-*Tree*, in botany. See the article CITRUS.—Orange-flowers are justly esteemed one of the finest perfumes: and though little used in medicine, yet the water distilled from them is accounted stomachic, cordial, and carminative. The fruit is cooling, and good in feverish disorders, and particularly in diarrhœas. Orange-peel is an agreeable aromatic, proper to repair and strengthen the stomach, and gives a very grateful flavour to any infusions or tinctures into whose compositions it enters. It is particularly useful in preparations of the bark: gives an agreeable warmth to the infusion; and, according to Dr Percival, considerably increases its virtue.

In the Philosophical Transactions, N° 114. there is a very remarkable account of a tree standing in a grove near Florence, having an *orange* stock, which had been so grafted upon, that it became in its branches, leaves, flowers, and fruit, three-formed: some emulating the orange, some the lemon or citron, and some partaking of both forms in one; and what was very remarkable, was, that these mixed fruits never produced any perfect seeds: sometimes there were no seeds at all in them, and sometimes only a few empty ones.

ORANGE-*Peel*. See CITRUS and ORANGE-*Tree*.

ORANGE-*Dew*, a kind of dew which falls in the spring time from the leaves of orange and lemon trees, which is extremely fine and subtile. M. de la Hire observing this, placed some flat pieces of glass under the leaves to receive it; and having procured some large drops of it, was desirous of discovering what it was. He soon found that it was not a merely aqueous fluid, because it did not evaporate in the air; and that it was not a resin, because it readily and perfectly mixed with water: it was natural then to suppose it a liquid gum; but neither did this, on examination, prove to be the case; for being laid on paper, it did not dry as the other liquid gums do. Its answering to none of these characters, and its being of the consistence of honey, and of a sweet sugar-like taste, gave a suspicion of its being a kind of manna; and whatever in the other trials had proved it not a resin, a gum, &c. all equally tends to prove that it is this substance.

Marsigli, *Hist. de la Mer.*

ORANGE, *Sea*, in natural history, a name given by Count Marsigli to a very remarkable species of marine substance, which he denominates a *plant*. It is tough and firm in its structure, and in many things resembles the common fucus; but instead of growing in the branched form which the generality of those substances have, it is round and hollow, and in every respect resembles the shape of an orange. It has, by way of root, some exceeding fine filaments, which fasten themselves to the rocks, or to shells, stones, or any thing else that comes in the way. From these there grows no pedicle; but the body of the orange, as it is called, is fastened by them to the rock, or other solid substance. The orange itself is usually of about three or four inches in diameter; and while in the sea, is full of water, and even retains it when taken up. In this state it frequently weighs a pound and a half; but when the water is let out, and it is dried, it becomes a mere membrane, weighing scarce any thing. It is best preserved, by stuffing it with cotton as soon as the water is let out of it, and then hanging it up to dry. Its surface is irregular and rough, and its colour a dusky green on the outside, and a clearer but somewhat bluish green within; and its thickness is about an eighth part of an inch. When viewed by the microscope, it is seen to be all over covered with small glandules, or rather composed of them; for they stand so thick one by another as to leave no space between, and seem to make up the whole substance; so that it appears very like the rough shagreen skin used to cover toys. These are indeed so many hollow ducts, through which the sea water finds a passage in the globe formed by this skin, and by this means it is kept always full and distended; on cutting it with a pair of scissars, the water immediately runs out, and the skins collapse; but there is something extremely remarkable in this, for the whole substance, near the wounded place, is in motion, and seems as if alive, and sensible of the wound. The glandules are found full of water, and resembling small transparent bottles; and what goes to the structure of the plant beside these, is an assemblage of a vast number of filaments, all which are likewise hollow, and filled with a clear and transparent fluid.

There is another substance of this kind, mentioned and described by Count Marsigli, Triumfetti, and others, and called the *ramose* or branched orange. This is very much of the nature of the former; but, instead of consisting of one round globule, it is formed of several oblong ones, all joined together, and representing the branches of some of the fucuses, only they are shorter; and these are all hollow and full of water, in the same manner as the single globes of the common kind. This has, by way of root, certain fine and slender filaments, which fasten it to the stones or shells near which it is produced; and it is of a dusky greenish colour on the surface, and of a fine bluish green within. The surface, viewed by the microscope, appears rough, as in the other, and the glandules are of the same kind, and are always found full of clear water. See CORALLINES.

Orator.

ORATION, in rhetoric, a speech or harangue, composed according to the rules of oratory, but spoken in public. Orations may be reduced to three kinds, viz. the demonstrative, deliberative, and judicial. To the demonstrative kind belong panegyrics, genethliaca, epithalamia, congratulations, &c. To the deliberative kind belong persuasion, exhortation, &c. And to the judicial kind belong accusation, confutation, &c.

*Funeral* ORATION. See FUNERAL *Oration*.

ORATOR, among the Romans, differed from a *patronus*: The latter was allowed only to plead causes on behalf of his clients; whereas the former might quit the forum and ascend the rostra or tribunal, to harangue the senate or the people. The orators had profound knowledge of the law, but they were eloquent, and their style was generally correct and

Orator. and concise. They were employed in causes of importance, instead of the common patrons. Orators in the violence of elocution used all the warmth of gesture, and even walked backwards and forwards with great heat and emotion. This it was which occasioned a witticism of Flavius Virginius, who asked one of those walking orators, *Quot millia passuum declamasset?* "How many MILES he had declaimed?" Similar to the Roman orators were the Grecian *Rhetores*. See RHETORES.

*Public* ORATOR, an office of very considerable dignity, and of some emolument in the English universities.

The public orator is the principal, and in many cases the only ostensible, agent for the university in all those matters or forms which are merely external. He carries on or superintends all correspondences which are calculated to promote the dignity, or raise the utility, of the seminary which constitutes him. He has little to do, indeed, with the internal government of the body, for which a variety of officers in different departments are appointed; but in all public affairs he is, as it were, the mouth of the whole; putting their deliberations into proper form, and communicating or publishing them, according to the intention of the university. Thus, if the whole university, or a committee appointed by them, or by statute, or by the will of any particular benefactor, have, after a comparative trial, adjudged a prize to any person or persons, it is the business of the public orator to inform the successful parties of the issue of the trial. Again, If for singular learning, or for any remarkable *good will* shown to the university by any person or persons, the *senate* or *convocation* are pleased to declare their grateful sense of it either by conferring degrees, or otherwise as they think fit, the public orator is to notify this intention to the person or persons concerned; and so in other cases.

Another part of the public orator's business is to present young noblemen, or those who take *honorary* degrees, *tanquam nobiles*, to the vice chancellor: this he does in a Latin speech, which, according to circumstances, is either short or long; and of which the subject is generally a defence of that particular statute which allows the sons of noblemen, and some few others, to proceed to degrees before what is called the *statutable time*. In doing this, encomiums, often stronger than just, are made upon the learning and virtue of the noble candidate; a view is taken of the dignity of his ancient house; the honour is mentioned which has accrued to the university from the accession of such a member; and the oration concludes with promising great credit from his future conduct, as well as benefit from the influence of his rank in the state. These circumstances are deemed sufficient grounds for exempting the sons of noblemen from that tedious course of study through which the duller sons of commoners must all pass before they be thought worthy of academical honours.

Oratorio. ORATORIO, in the Italian music, a sort of sacred drama of dialogues; containing recitativos, duettos, trios, ritornellos, choruses, &c. The subjects of those pieces are usually taken from Scripture, or the life of some saint, &c. The music for the oratorios should be in the finest taste and best chosen strains. These oratorios are greatly used at Rome in the time of Lent, and of late in England.

Menestrier attributes the origin of oratorios to the crusades, and says that the pilgrims returning from Jerusalem and the Holy Land, &c. composed songs reciting the life and death of the Son of God, and the mysteries of the Christian faith, and celebrating the achievements and constancy of saints and martyrs. Others, with more probability, observe, that the oratorio was an avowed imitation of the opera, with only this difference, that the foundation of it was al[illegible] religious, or at lea[illegible] subject. Cr[illegible] its origin [illegible] Neri, who was bor[illegible]rence in 15[illegible] his chapel, after [illegible] other devotio[illegible] to allure young people [illegible] ous offices, [illegible] ms, and such like pray[illegible] sung by one [illegible] Among these spiritual songs were dial[illegible] these entertainments beco[illegible]ing more frequent, and improving every year, were [illegible] occasion that in the seventeenth ce[illegible]torios [illegible] first invented, so called from the [illegible] origin. See *Hawkins's History of Music*.

# ORATORY;

THE ART OF SPEAKING WELL UPON ANY SUBJECT, IN ORDER TO PERSUADE.

## INTRODUCTION.

### § 1. *Of the Rise and Progress of Oratory.*

THE invention of oratory is by the Egyptians, and the fables of the poets, ascribed to Mercury. And it is well known, that the Greeks made their deities the authors likewise of other arts, and supposed that they presided over them. Hence they gave Mercury the titles of Λογιος and Ἑρμης, both which names come from words that signify "to speak." And Aristides calls eloquence *the gift of Mercury*; and for the same reason anciently the tongue was consecrated to him. He was likewise said to be the interpreter or messenger of the gods; which office very well suited him, as he excelled in eloquence. Hence we read in the Sacred Writings, that when the people of Lystra took Barnabas and Paul for gods in human shape, because of that sudden and surprising cure which was wrought upon the lame man, they called Barnabas *Jupiter*, and Paul *Mercury*; for this reason, as the inspired writer tells us, 'because he was the chief speaker,' that is (as the spectators then thought), the interpreter or spokesman of Barnabas.

1 The origin of the art of oratory.

But to pass over these fictions of the heathen deities, let us hear what Quintilian says of the *origin* of this art; who seems to give a very probable account of it in the following passage. "The faculty of speech (says

(says he) we derive from nature (A); but the art from observation. For as in physic, men, by seeing that some things promote health and others destroy it, formed the art upon those observations; in like manner, by perceiving that some things in discourse are said to advantage, and others not, they accordingly marked those things, in order to imitate the one and avoid the other. They also added some things from their own reason and judgment, which being confirmed by use, they began to teach others what they knew themselves." But no certain account can be given when, or by whom, this method of observation first began to take place. And Aristotle supposes, not without reason, that the first lineaments of the art were very rude and imperfect. Pausanias, indeed, in his *Description of Greece*, tells us, that Pittheus, the uncle of Theseus, taught it at Trœzene a city of Peloponnesus, and wrote a book concerning it; which he read himself, as it was published by one of Epidaurus. But as Pittheus lived about 1000 years before Pausanias, who flourished in the time of the emperor Hadrian, some are of opinion he might be imposed upon by the Epidaurian, who published this book under the name of *Pittheus*. But be that as it will, it is very reasonable to believe, that the Greeks had the principles of this art so early as the time of Pittheus. For Theseus his nephew lived not long before the taking of Troy, which, according to Sir Isaac Newton, happened 904 years before the birth of Christ; at which time Cicero thought it was in much esteem among them. "Homer (says he) could never have given Ulysses and Nestor in the Trojan war so great commendations on account of their speeches (to one of whom he [illegible]butes force, and to the other sweetness [illegible] eloquence had not in those times been [illegible]ute." And lest any one should imagine [illegible]se days they made use only of such [illegible] and practice could afford them, the same [illegible] us, that Peleus sent Phœnix with his son Achilles to the Trojan war, to instruct him not only in the art of war, but likewise of eloquence. But who were the professors of this art for some ages following is not known. For Quintilian says, that afterwards Empedocles is the first upon record who attempted any thing concerning it. And he, by Sir Isaac Newton's account, flourished about 500 years after Troy was taken. At which time, as Cicero observes, men being now sensible of the powerful charms of oratory, and the influence it had upon the mind, there immediately arose several masters of it; the chief of whom are mentioned by Quintilian, who tells us, that 'the oldest writers upon this art are Corax and Tisias, both of Sicily. After them came Gorgias of Leontium in the same island, who is said to have been the scholar of Empedocles, and by reason of his great age (for he lived to be 109 years old) had many cotemporaries. Thrasymachus of Chalcedon, Prodicus of Cea, Protagoras of Abdera, Hippias of Elis, and Alcidamus of Elea, lived in his time; as likewise Antiphon, who first wrote orations, and also upon the art, and is said to have spoken admirably well in his own defence; and besides these, Polycrates, and Theodore of Byzantium.' These persons contributed different ways towards the improvement of the art. Corax and Tisias gave rules for methodizing a discourse, and adjusting its particular parts; as may be conjectured from Cicero's account of them, who says, "Though some had spoke well before their time, yet none with order and method." But Gorgias seems to have excelled all the rest in fame and reputation: for he was so highly applauded by all Greece, that a golden statue was erected to him at Delphos, which was a distinguishing honour conferred upon him only. And he is said to have been so great a master of oratory, that in a public assembly he would undertake to declaim immediately upon any subject proposed to him. He wrote, as Cicero informs us, in the demonstrative or laudatory way; which requires most of the sublime, and makes what Diodorus Siculus says of him the more probable, that "he first introduced the strongest figures, members of periods opposite in sense, of an equal length, or ending with a like sound, and other ornaments of that nature." And hence those figures, which give the greatest force and lustre to a discourse, were anciently called by his name. Cicero tells us further, that Thrasymachus and Gorgias were the first who introduced numbers into prose, which Isocrates afterwards brought to perfection. Quintilian likewise mentions Protagoras, Gorgias, Prodicus, and Thrasymachus, as the first who treated of common places, and showed the use of them for the invention of arguments. Nor must we omit Plato, whose elegant dialogue upon this subject is still extant, which he entitles *Gorgias*. For though he does not lay down the common rules of the art; yet he very well explains the nature of it, and maintains its true end and use against the generality of its professors, who had greatly perverted the original design of it. Thus by the study and industry of so many ingenious and great men, the art of oratory was then carried to a considerable height among the Grecians: though many of those who professed it in those times employed their skill rather to promote their own reputation and applause, than to serve the real interests of truth and virtue. "For they proposed in an arrogant manner (as Cicero says) to teach how a bad cause might be so managed, as to get the better of a good one." That is, they would undertake to charm the ears and strike the passions of their hearers in so powerful a manner, by sophistical reasonings, turns of wit, and fine language, as to impose falsehood upon them for truth; than which nothing could be either more disingenuous in itself, or prejudicial to society.

8
Orators of Greece.

But those who succeeded them seem to have consulted better, both for their own honour and that of their profession. Isocrates was the most renowned of all



(A) If Quintilian meant that the human race speak an articulate language by nature or instinct, he certainly deceived himself (see LANGUAGE); but if his meaning was only that men have from nature a capability of speech, the observation is true, but not of much value. Parrots and other birds have a capability of uttering articulate sounds.

all Gorgias's scholars, whom Cicero frequently extols with the highest commendations, as the greatest master and teacher of oratory; "whose school (as he says) like the Trojan horse, sent forth abundance of great men." Aristotle was chiefly induced to engage in this province from an emulation of his glory; and would often say in a verse of Sophocles, somewhat varied to his purpose,

> To be silent it is a shame;
> While Isocrates gets such fame.

Quintilian says they both wrote upon the art, though there is no system of the former now extant. But that of Aristotle is esteemed the best and most complete of any in the Greek language. In this age the Grecian eloquence appeared in its highest perfection. Demosthenes was a hearer both of Isocrates and Plato, as also of Isæus (ten of whose orations are yet extant); and by the assistance of a surprising genius, joined with indefatigable industry, made that advantage of their precepts, that he has been always esteemed by the best judges the prince of Grecian orators. His great adversary and rival Æschines, after his banishment, is said to have gone to Rhodes, and employed his time there in teaching of rhetoric. Theodectes and Theophrastus, both of them scholars of Aristotle, imitated their master in writing upon the art. And from that time the philosophers, especially the Stoics and Peripatetics, applied themselves to lay down the rules of oratory; which Socrates had before separated from the province of a philosopher. And there is yet preserved a treatise upon this subject, which some have ascribed to Demetrius Phalereus the Peripatetic, and scholar of Theophrastus, though others more probably to Dionysius of Halicarnassus. Quintilian mentions several other famous rhetoricians in the following ages, who were likewise writers: As Hermagoras, Athenæus, Apollonius Molon, Areus Cæcilius, Dionysius of Halicarnassus, Apollonius of Pergamus, and Theodore of Gadara. But of these nothing now remains upon the subject of oratory, except some tracts of Dionysius, who flourished in the reign of Augustus Cæsar. Nor have there been wanting some eminent writers of this kind among the Greeks since the time of Quintilian; two of whom we cannot omit to mention, Hermogenes, and Longinus the author of the incomparable treatise *Of the Sublime*, a book which can scarce be too much commended or too often read.

3
Rise and progress of oratory in Rome.

It was long before Rome received this art, and not without difficulty at first. The reason was, because the Romans were for several ages wholly addicted to military affairs, and to enlarge their territories; so that they not only neglected to cultivate learning, but thought the pursuit of it a thing of ill tendency, by diverting the minds of their youth from the cares and toils of war, to a more soft and indolent kind of life. Therefore so late as the year of their city 592, when by the industry of some Grecians the liberal arts began to flourish in Italy, a decree passed the senate, by which all philosophers and rhetoricians were ordered to depart out of Rome. But in a few years after, when Carneades, Critolaus, and Diogenes, who were not only philosophers but orators, came ambassadors from Athens to Rome, the Roman youth were so charmed with the eloquence of their harangues, that they could no longer be stopt from pursuing the study of oratory. And by a further acquaintance with the Greeks, it soon gained such esteem, that persons of the first quality employed their time and pains to acquire it. And a young gentleman, who was ambitious to advance himself in the service of his country, could have little hopes of success, unless he had laid the foundation of his future prospects in that study.

Seneca tells us, that Lucius Plotius, a Gaul, was the first who taught the art of oratory at Rome in Latin; which, Cicero says, was while he was a boy; and when the most studious persons went to hear him, he lamented that he could not go with them; being prevented by the regard he paid to the opinion of some of his friends, who thought that greater improvements were made by exercises in the Greek language under Grecian masters. Seneca adds, that this profession continued for some time in the hands of freedmen; and that the first Roman who engaged in it was Blandus of the equestrian order, who was succeeded by others; some of whose lives are yet extant, written by Suetonius, as many of the Grecians are by Philostratus and Eunapius. Quintilian likewise gives us the names of those among the Romans, who wrote upon the art. "The first (says he), as far as I can learn, who composed any thing upon this argument, was M. Cato the censor. After him Antony the orator began upon the subject, which is the only work he has left, and that imperfect. Then followed some of less note. But he who carried eloquence to its highest pitch among us, was Cicero; who has likewise by his rules given the best plan both to practise and teach the art. After whom modesty would require us to mention no more, had he not told us himself that his books of rhetoric slipt out of his hands, while he was but a youth. And those lesser things, which many persons want, he has purposely omitted in his discourses of oratory. Cornificius wrote largely upon the same subject; Stertinius and Gallio the father, each of them something. But Celsus and Lenas were more accurate than Gallio; and in our times Virginius, Pliny, and Rutilius. And there are at this day some celebrated authors of the same kind, who, if they had taken in every thing, might have saved my pains." Time has since deprived us of most of the writers mentioned here by Quintilian. But we have the less reason to regret this loss, since it has preserved to us Cicero's treatises upon this subject; which we may well suppose to have been chiefly owing to their own excellency, and the great esteem they have always had in the world. Besides his *Two books of Invention*, which Quintilian here calls his *Books of Rhetoric*, there are extant of his, *Three books of an Orator*; one *Of famous Orators*; and another, which is called *The Orator*; as also his *Topics*, a preface *Concerning the best sort of Orators*, and a treatise *Of the parts of Oratory*. Each of which treatises, whether we regard the justness and delicacy of the thoughts, the usefulness of the rules, or the elegance and beauty of the style, deserves to be frequently perused by all who are lovers of eloquence. For who can be thought so well qualified to give the rules of any art, as he who excelled all mankind in the practise of them? But those *Four books to Herennius*, which are published among Cicero's works, seem with good reason to be attributed to Cornificius, whom Quintilian

Quintilian here mentions. And Celſus is by ſome affirmed to have taught oratory, whom he alſo places among the rhetoricians, and whoſe *Eight Books of Medicine* are yet extant, written in ſo beautiful a ſtyle as plainly ſhows him to be a maſter of eloquence. But Quintilian himſelf outdid all who went before him in diligence and accuracy as a writer. His *Inſtitutions* are ſo comprehenſive, and written with ſuch great exactneſs and judgment, that they are generally allowed to be the moſt perfect work of the kind. With this excellent author we ſhall finiſh the account of the Latin rhetoricians.

There were indeed ſome others in the following ages, whoſe works are yet extant; but as they contain nothing of moment which is not to be found in thoſe already mentioned, we ſhall forbear to name them. Much leſs ſhall we deſcend to that numerous body of writers, who ſince the revival of learning have treated upon this ſubject, for the ſame reaſon. And a very good judge * has not long ſince given it as his opinion, that the method of forming the beſt ſyſtem of oratory, is to collect it from the fineſt precepts of Ariſtotle, Cicero, Quintilian, Longinus, and other celebrated authors; with proper examples taken from the choiceſt parts of the pureſt antiquity. And this is the method attempted to be purſued in the following treatiſe.

* Archb. Cambray, *Lett.* p. 213.

## § 2. *Of the Nature of Oratory.*

The terms *rhetoric* and *oratory*, having no other difference but that one is taken from the Greek language and the other from the Latin, may be uſed promiſcuouſly; but the caſe is not the ſame with reſpect to the words *rhetorician* and *orator*. For although the Grecians uſed the former, both to expreſs thoſe who taught the art, and thoſe who practiſed it; yet the Romans afterward, when they took that word into their language, confined it to the teachers of the art, and called the reſt *orators*. And there ſeems to have been a ſufficient reaſon for this diſtinction, ſince the art was the ſame in both, and might therefore go by either name; but the different province of rhetoricians and orators made it not improper that they ſhould be called by different names. Beſides, anciently, before rhetoric was made a ſeparate and diſtinct art from philoſophy, the ſame perſons taught both. And then they were called not only *rhetoricians* but *ſophiſts*. But becauſe they often employed their art rather to vindicate what was falſe and unjuſt, than to ſupport truth and virtue; this diſingenuous conduct by which they frequently impoſed upon weak minds, brought a diſcredit both upon themſelves and their profeſſion. And therefore the name *ſophiſt* or *ſophiſter*, has been more generally uſed in an ill ſenſe, to ſignify one ſkilled rather in the arts of cavilling, than qualified to ſpeak well and accurately upon any ſubject.

It is not neceſſary to uſe many words, to prove that oratory is an art. For it is compriſed under certain rules, agreeable to reaſon, delivered in a regular method, and ſuited to attain the end it propoſes; which are characters ſufficient to denominate it an art. Indeed the caſe is the ſame here as in moſt other things, that a good genius is of itſelf more ſerviceable than the moſt exact acquaintance with all the rules of art, where that is wanting. But it is ſufficient that art help nature, and carry it farther than it can otherwiſe advance without it. And he who is deſirous to gain the reputation of a good orator, will find the aſſiſtance of art very neceſſary. Some perſons have thought, that many of the common ſyſtems written upon the ſubject of oratory have been attended with this inconvenience, that, by burdening the mind with too great a number of rules about things of leſs importance, they have oftentimes rather diſcouraged than promoted the ſtudy of eloquence. This undoubtedly is an extreme which ſhould be always carefully avoided. But, however, an indifferent guide in a ſtrange road is better than none at all. It may be worth while to hear Quintilian's opinion upon this head. "I would not (ſays he) have young perſons think they are ſufficiently inſtructed, if they have learned one of thoſe compends which are commonly handed about, and fancy themſelves ſafe in the decrees, as it were, of theſe technical writers. The art of ſpeaking requires much labour, conſtant ſtudy, a variety of exerciſe, many trials, the greateſt prudence, and readineſs of thought. However, theſe treatiſes are uſeful, when they ſet you in a plain and open way, and do not confine you to one narrow track, from which he who thinks it a crime to depart muſt move as ſlowly as one that walks upon a rope." We ſee he is not for having us confine ourſelves too cloſely to ſyſtems, though he thinks they are of ſervice at firſt, till uſe and experience render them leſs neceſſary.

5 The buſineſs of oratory is to teach us to ſpeak well; which, as Cicero explains it, is to ſpeak *juſtly*, *methodically*, *floridly*, and *copiouſly*. The object of it.

Now, in order to ſpeak *juſtly*, or pertinently, a perſon muſt be maſter of his ſubject, that he may be able to ſay all that is proper, and avoid whatever may appear foreign and trifling. And he muſt clothe his thoughts with ſuch words and expreſſions as are moſt ſuited to the nature of the argument, and will give it the greateſt force and evidence.

And as it teaches to ſpeak juſtly, ſo likewiſe *methodically*. This requires, that all the parts of a diſcourſe be placed in their proper order, and with ſuch juſt connexion, as to reflect a light upon each other, and thereby to render the whole both clear in itſelf, and eaſy to be retained. But the ſame method is not proper for all diſcourſes. And very frequently a different manner is convenient in handling the ſame ſubject. For it is plain, that art, as well as nature, loves variety; and it diſcovers the ſpeaker's judgment, when the diſpoſition of his diſcourſe is ſo framed, as to appear eaſy and natural, rather than the effect of induſtry and labour.

To ſpeak *floridly*, is ſo peculiar a property of this art, that ſome have wholly confined it to the pomp and ornaments of language. But that it extends farther, and reſpects things as well as words, we ſhall have occaſion to ſhow hereafter. It contains indeed the whole ſubject of elocution, but does not wholly conſiſt in it. True and ſolid eloquence requires not only the beauties and flowers of language, but likewiſe the beſt ſenſe and cleareſt reaſoning. Beſides, rhetoric gives rules for the ſeveral ſorts of ſtyle, and directs the uſe of them agreeably to the nature of the ſubject.

But the force of oratory appears in nothing more than

than a copiousness of expression, or a proper manner of enlargement, suited to the nature of the subject; which is of great use in persuasion, and forms the last property, required by Cicero, of speaking well. A short and concise account of things is often attended with obscurity, from an omission of some necessary circumstances relating to them. Or, however, where that is not the case, yet for want of proper embellishments to enliven the discourse, and thereby to excite and fix the hearers attention, it is apt to slip through their minds without leaving any impression. But where the images of things are drawn in their full proportion, painted in their proper colours, set in a clear light, and represented in different views, with all the strength and beauties of eloquence, they captivate the minds of the audience with the highest pleasure, engage their attention, and by an irresistible force move and bend them to the design of the speaker.

The principal end and design of oratory is to persuade: for which reason it is frequently called the *art of persuasion*. Indeed the orator has often other subordinate views; as when he endeavours either to delight his hearers with what is pleasant and agreeable, or to conciliate their good opinion by a smooth and artful address: but still both these are in order to persuade and excite them to action.

An objection may, perhaps, hence be formed against eloquence, as an art which may be employed for persuading to ill as well as to good. There is no doubt that it may; and so reasoning may also be, and too often is, employed for leading men into error. But who would think of forming an argument from this against the cultivation of our reasoning powers? Reason, eloquence, and every art which ever has been studied among mankind, may be abused, and may prove dangerous in the hands of bad men; but it were perfectly childish to contend, that upon this account they ought to be abolished.

While the orator employs his art in pursuing only those ends for which it was at first designed, the persuading men to good and virtuous actions, and dissuading them from every thing that is ill and vicious; nothing can more be commendable in itself, or useful to human societies.

### § 3. *Of the Division of Oratory.*

6 Oratory consists of four parts.

Oratory consists of four parts; *invention, disposition, elocution*, and *pronunciation*. This will appear by considering the nature of each of them, and what it contributes in forming an orator. Every one who aims to speak well and accurately upon any subject, does naturally in the first place inquire after and pursue such thoughts as may seem most proper to explain and illustrate the thing upon which he designs to discourse. And if the nature of it requires that he should bring reasons to confirm what he says, he not only seeks the strongest, and such as are like to be best received; but also prepares to answer any thing which may be offered to the contrary. This is *invention*.—After this he deliberates with himself in what method to dispose of those things which have occurred to his mind, that they may appear in the plainest light, and not lose their force by disorder and confusion. This is the business of *disposition*.—His next concern is to give his thoughts an agreeable dress; by making choice of the fittest words, clearest expressions, smooth and harmonious periods, with other ornaments of style, as may best suit the nature of his subject, brighten his discourse, and render it most entertaining to his hearers. And this is called *elocution*.—The last thing he attends to, is to deliver what he has thus composed, with a just and agreeable *pronunciation*. And daily experience convinces us, how much this contributes both to engage the attention and impress what is spoken upon the mind. This then is the method to which nature directs, in order to qualify ourselves for discoursing to the best advantage: Though by custom and habit these things become so familiar to us, that we do not always attend to them separately in their natural order. However, it is the business of art to follow nature, and to treat of things in that manner which she dictates.

# PART I. OF INVENTION.

## Chap. I. *Of Invention in general; and particularly of Common Places, and State of a Cause.*

Invention the discovery of such things as are fitted to persuade.

INVENTION, considered in general, is the discovery of such things as are proper to persuade. And in order to attain this end, the orator proposes to himself three things: To prove or illustrate the subject upon which he treats; to conciliate the minds of his hearers; and to engage their passions in his favour. And as these require different kinds of arguments or motives, invention furnishes him with a supply for each of them, as will be shown in their order.

An argument, as defined by Cicero, is a reason which induces us to believe what before we doubted of.

And as different kinds of discourses require different arguments, rhetoricians have considered them two ways; in general, under certain heads, as a common fund for all subjects; and in a more particular manner, as they are suited to *demonstrative, deliberative*, or *judicial* discourses. At present we shall treat only upon the former of these. And now, that one thing may receive proof and confirmation from another, it is necessary that there be some relation between them; for all things are not equally adapted to prove one another. Thus, in measuring the quantity of two things which we would show to be either equal or unequal, if they are of such a nature that one cannot be applied to the other, then we take a third thing, which may be applied to them both; and that must be equal at least to one of the two, which if applied to the other, and found equal to that also, we presently conclude that these two things are equal; but if it be unequal to the other, we say that these two things are unequal. Because it is the certain and known property of all quantities, that whatsoever two things are equal to a third, are equal to one another; and where one of any two things is equal to a third, and the other unequal, those two things are unequal to one another. What has been said of quantities, will hold true in all other cases, that so far as any two things or ideas agree

Invention.

agree to a third, so far they agree to one another. So likewise, on the contrary, as far as one of any two things or ideas does agree to a third, and the other does not, so far they disagree with one another; in which respect, one of them cannot be truly affirmed of the other. Since, therefore, in every proposition, one thing is spoken of another, if we would find out whether the two ideas agree to each other or not, where this is not evident of itself, we must find out some third thing, the idea of which agrees to one of them; and then that being applied to the other, as it does agree or disagree with it, so we may conclude, that the two things proposed do agree or disagree with one another. This will be made more clear by an example or two. Should it be inquired, *Whether virtue is to be loved;* the argument between virtue and love might be found by comparing them separately with happiness, as a common measure to both. For since the idea of happiness agrees to that of love, and the idea of virtue to that of happiness; it follows, that the ideas of virtue and love agree to one another: and therefore it may be affirmed, *That virtue is to be loved.* But, on the contrary, because the idea of misery disagrees with that of love, but the idea of vice agrees to that of misery, the two ideas of vice and love must consequently disagree with one another; and therefore it would be false to assert, *That vice is to be loved.* Now, this third thing logicians call the *medium,* or *middle term,* because it does as it were connect two extremes; that is, both parts of a proposition. But rhetoricians call it an *argument,* because it is so applied to what was before proposed, as to become the instrument of procuring our assent to it. Thus far as to the nature and use of arguments. We shall next explain by what methods they are to be sought.

8
These called arguments.

A lively imagination, and readiness of thought, are undoubtedly a very great help to invention. Some persons are naturally endued with that quickness of fancy, and penetration of mind, that they are seldom at a loss for arguments either to defend their own opinions, or to attack their adversaries. However, these things being the gift of nature, and not to be gained by art, do not properly fall under our present consideration.

9
Learning necessary to an orator.

It will be readily granted, that great learning and extensive knowledge are a noble fund for invention. An orator therefore should be furnished with a stock of important truths, solid maxims of reason, and a variety of knowledge, collected and treasured up both from observation and a large acquaintance with the liberal arts, that he may not only be qualified to express himself in the most agreeable manner, but likewise to support what he says with the strongest and clearest arguments.

But because all are not born with a like happy genius, and have not the same opportunity to cultivate their minds with learning and knowledge; and because nothing is more difficult than to dwell long upon the consideration of one thing, in order to find out the strongest arguments which may be offered for and against it; upon these accounts, art has prescribed a method to lessen, in some measure, these difficulties, and help every one to a supply of arguments upon any subject. And this is done by the contrivance of *common places,* which Cicero calls the *seats* or *heads of arguments,* and by a Greek name *topics.* They are of two sorts, *internal* and *external.*

10
Rules of art to supply the place of extensive learning or acute genius.

I. *Internal topics.* Though things, with regard to their nature and properties, are exceedingly various, yet they have certain common relations, by means whereof the truth of what is either affirmed or denied concerning them in any respect may be evinced. The ancient Greek rhetoricians therefore reduced these relations to some general heads, which are termed *loci* or *common places;* because the reasons or arguments suited to prove any proposition are reposited in them, as a common fund or receptacle. And they are called *internal heads,* because they arise from the subject upon which the orator treats; and are therefore distinguished from others named *external,* which he fetches from without, and applies to his present purpose, as will be shown hereafter. Cicero and Quintilian make them 16; three of which comprehend the whole thing they are brought to prove, namely, *definition, enumeration,* and *notation:* of the remaining 13, some contain a part of it, and the rest its various properties and circumstances, with other considerations relating to it; and these are, *genus, species, antecedents, consequents, adjuncts, conjugates, cause, effect, contraries, opposites, similitude, dissimilitude,* and *comparison.*

*Definition* explains the nature of the thing defined, and shows what it is. And to whatsoever the definition agrees, the thing defined does so likewise. If therefore Socrates be a rational creature, he is a man; because it is the definition of a man, that he is a rational creature.

*Enumeration* takes in all the parts of a thing. And from this we prove, that what agrees to all the parts agrees to the whole; and what does not agree to any one or more parts, does not agree to the whole: As when Cicero proves to Piso that all the Roman state hated him, by enumerating the several ranks and orders of Roman citizens who all did so.

*Notation,* or etymology, explains the meaning or signification of a word. From which we reason thus: "If he cannot pay his debts, he is insolvent;" for that is the meaning of the word *insolvent.*

*Genus* is what contains under it two or more sorts of things, differing in nature. From this head logicians reason thus: "Because every animal is mortal, and man is an animal, therefore man is mortal." But orators make a further use of this argument, which they call *ascending from the hypothesis to the thesis;* that is, from a particular to a general: As should a person, when speaking in praise of justice, take occasion from thence to commend and show the excellency of virtue in general, with a view to render that particular virtue more amiable. For since every species contains in it the whole nature of the genus to which it relates, besides what is peculiar to itself, whereby it is distinguished from it; what is affirmed of the genus, must of necessity be applicable to the species.

*Species* is that which comprehends under it all the individuals of the same nature. From hence we may argue, "He is a man, therefore he has a rational soul." And orators sometimes take occasion from this head to descend from the thesis to the hypothesis; that

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that is, in treating upon what is more general, to introduce some particular contained under it, for the greater illustration of the general.

*Antecedents* are such things, as, being once allowed, others necessarily, or very probably, follow. From this head an inseparable property is proved from its subject: as, It is material, and therefore corruptible.

*Consequents* are such things as, being allowed, necessarily or very probably infer their antecedents. Hence the subject is proved from an inseparable property, in this manner: It is corruptible, and therefore material.

*Adjuncts* are separable properties of things, or circumstances that attend them. These are very numerous, and afford a great variety of arguments, some of which usually occur in every discourse. They do not necessarily infer their subject; but, if fitly chosen, render a thing credible, and are a sufficient ground for assent. The way of reasoning from them we shall show presently.

*Conjugates* are words deduced from the same origin with that of our subject. By these the habit is proved from its acts: as, He who does justly is just. He does not act wisely, therefore he is not wise. But this inference will not hold, unless the actions appear continued and constant.

A *cause* is that, by the force of which a thing does exist. There are four kinds of causes, matter, form, efficient, and end, which afford a great variety of arguments. The way of reasoning from them is to infer the effect from the cause: as, Man is endued with reason, therefore he is capable of knowledge.

An *effect* is that which arises from a cause, therefore the cause is proved by it: as, He is endued with knowledge, therefore with reason.

*Contraries* are things, which, under the same genus, are at the utmost distance from each other; so that what we grant to the one, we utterly deny the other: as Virtue ought to be embraced, therefore vice should be avoided.

*Opposites* are such things, which, though repugnant to each other, yet are not directly contradictory; as, To love and to injure, to hate and to commend. They differ from contraries in this, that they do not absolutely exclude one another. An argument is drawn from things repugnant, thus: He will do a man a mischief, therefore he does not love him. He loves a man, therefore he will not reproach him.

*Similitude* is an agreement of things in quality. Thus Cicero proves, that pernicious citizens ought to be taken out of the state; by the likeness they bear to corrupted members, which are cut off to prevent further damage to the body.

*Dissimilitude* is a disagreement of things in quality. From this head Cicero shows the preference of his own exile to Piso's government of Macedonia; by the difference between their conduct, and the people's esteem of them.

*Comparison* is made three ways: for either a thing is compared with a greater, with a less, or with its equal. This place, therefore, differs from that of similitude on this account, that the quality was considered in that, but here the quantity. An argument from the greater is thus drawn: If five legions could not conquer the enemy, much less will two.

We shall just give one example of the manner of reasoning from these heads, whereby the use of them may further appear. If any one, therefore, should have endeavoured to persuade Cicero not to accept of his life upon the condition offered him by Antony, That he would burn his Philippic orations which had been spoken against him, he might be supposed to use such arguments as these; partly taken from the adjuncts of Cicero, partly from those of Antony, and partly from the thing itself. And first with regard to Cicero, it might be said, That so great a man ought not to purchase his life at so dear a price as the loss of that immortal honour which by so great pains and labour he had acquired. And this might be confirmed by another argument, That now he was grown old, and could not expect to live much longer. And from the character of Antony he might argue thus: That he was very crafty and deceitful; and only designed, by giving him hopes of life, to have the Philippics first burnt, which otherwise he knew would transmit to posterity an eternal brand of infamy upon him; and then he would take off the author. And this might be shown by comparison. For since he would not spare others, who had not so highly exasperated him, and from whom he had not so much to fear; certainly he would not forgive Cicero, since he knew well enough, that so long as he lived, he himself could never be in safety. And, lastly, An argument might also be fetched from the nature of the thing itself, in the following manner: That Cicero by this action would shamefully betray the state, and the cause of liberty, which he had through his whole life most courageously defended, with so great honour to himself, and advantage to the public. Upon such an account, a person might have used these or the like arguments with Cicero, which arise from the forementioned heads.

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11
The manner of reasoning from these heads.

From this account of common places, it is easy to conceive what a large field of discourse they open to the mind upon every subject. At the same time, though we have mentioned them from our respect for the orators of Greece and Rome, we heartily subscribe to the opinion of a celebrated modern, who gives of them the following account.

They are of no solid utility unless there is a previous foundation of learning and genius.

"The Grecian sophists were the first inventors of this artificial system of Oratory; and they showed a prodigious subtility and fertility in the contrivance of these loci. Succeeding rhetoricians, dazzled by the plan, wrought them into so regular a system, that one would think they meant to teach how a person might mechanically become an orator, without any genius at all. They gave him receipts for making speeches on all manner of subjects. At the same time, it is evident, that though this study of common places might produce very showy academical declamations, it could never produce useful discourses on real business. The loci indeed supplied a most exuberant fecundity of matter. One who had no other aim, but to talk copiously and plausibly, by consulting them on every subject, and laying hold of all that they suggested, might discourse without end; and that, too, though he had none but the most superficial knowledge of his subject. But such discourse could be no other than trivial. What is truly solid and persuasive, must be drawn *ex visceribus causæ*, from a thorough knowledge of the subject, and profound meditation on it. They who

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13 Of external topics, generally called *testimonies*.

II. *Of external topics*. When the orator reasons from such topics as do not arise from his subject, but from things of a different nature, these are called *external*. They are all taken from authorities, and are by one general name called *Testimonies*.

Now a testimony may be expressed by writing, speech, or any other sign proper to declare a person's mind. And all testimonies may be distinguished into two sorts, divine and human. A divine testimony, when certainly known to be such, is incontestable, and admits of no debate, but should be acquiesced in without hesitation. Indeed the ancient Greeks and Romans esteemed the pretended oracles of their deities, the answers of their augurs, and the like fallacies, divine testimonies: but with us no one can be ignorant of their true notion, though they do not so directly come under our present consideration. Human testimonies, considered as furnishing the orator with arguments, may be reduced to three heads; *writings*, *witnesses*, and *contracts*.

14 Reduced to three heads, and separately explained.

1. By *Writings*, here, are to be understood written laws, wills, or other legal instruments, expressed and conveyed in that manner. And it is not so much the force and validity of such testimonies, considered in themselves, that is here intended, as the occasion of dispute which may at any time arise concerning their true design and import, when produced in proof upon either side of a controversy. And these are five; Ambiguity, Disagreement between the words and intention, Contrariety, Reasoning, and Interpretation.

A writing is then said to be ambiguous, when it is capable of two or more senses, which makes the writer's design uncertain. Now ambiguity may arise either from single words, or the construction of sentences. From single words; as when either the sense of a word, or the application of it, is doubtful. As, should it be questioned, whether ready money ought to be included under the appellation of chattels left by a will: or, if a testator bequeath a certain legacy to his nephew Thomas, and he has two nephews of that name. But ambiguity is also sometimes occasioned from the construction of a sentence; as when several things or persons having been already mentioned, it is doubtful to which of them that which follows ought to be referred. For example, a person writes thus in his will: 'Let my heir give as a legacy to Titius a horse out of my stable, which he pleases.' Here it may be questioned, whether the word *he* refers to the heir or to Titius; and consequently, whether the heir be allowed to give Titius which horse he pleases, or Titius may choose which he likes best. Now as to controversies of this kind, in the first case above mentioned, the party who claims the chattels may plead, that all moveable goods come under that name, and therefore that he has a right to the money. This he will endeavour to prove from some instances where the word has been so used. The business of the opposite party is to refute this, by showing that money is not there included. And if either side produce precedents in his favour, the other may endeavour to show that the cases are not parallel. As to the second case, arising from an ambiguity in the name, if any other words or expressions in the will seem to countenance either of the claimants, he will not fail to interpret them to his advantage. So likewise, if any thing said by the testator, in his lifetime, or any regard shown to either of these nephews more than the other, may help to determine which of them was intended, a proper use may be made of it. And the same may be said with regard to the third case. In which the legatee may reason likewise from the common use of language, and show that in such expressions it is usual to make the reference to the last or next antecedent; and from thence plead, that it was the design of the testator to give him the option. But in answer to this, it may be said, that allowing it to be very often so, yet in this instance it seems more easy and natural to repeat the verb *give* after *pleases*, and so to supply the sentence, *which he pleases to give him*, referring it to the heir, than to bring in the verb *choose*, which was not in the sentence before; and so, by supplying the sense, *which he pleases to choose*, to give the option to Titius. But where controversies of this kind arise from a law, recourse may be had to other laws where the same thing has been expressed with greater clearness; which may help to determine the sense of the passage in dispute.

A second controversy from writings is, when one party adheres to the words, and the other to what he asserts was the writer's intention. Now he who opposes the literal sense, either contends, that what he himself offers is the simple and plain meaning of the writing, or that it must be so understood in the particular case in dispute. An instance of the former is this, as we find it in Cicero. A person who died without children, but left a widow, had made this provision in his will: "If I have a son born to me, he shall be my heir." And a little after: "If my son die before he comes of age, let Curius be my heir." There is no son born: Curius therefore sues for the estate, and pleads the intention of the testator, who designed him for his heir, if he should have no son who arrived at age; and says, there can be no reason to suppose he did not intend the same person for his heir if he had no son, as if he should have one who afterwards died in his minority. But the heir at law insists upon the words of the will; which, as he says, require, that first a son should be born, and afterwards die under age, before Curius can succeed to the inheritance; and there being no son, a substituted heir, as Curius was, can have no claim where the first heir does not exist, from whom he derives his pretension, and was to succeed by the appointment of the will.— Of the latter case, rhetoricians give this example: "It was forbidden by a law to open the city gates in the night. A certain person notwithstanding, in time of war, did open them in the night, and let in some auxiliary troops, to prevent their being cut off by the enemy, who was posted near the town." Afterwards, when the war was over, this person is arraigned, and tried for his life on account of this action. Now, in such a case, the prosecutor founds his charge upon the express words of the law; and pleads, that no sufficient reason can be assigned for going contrary to the letter of it, which would be to make a new law, and not to execute one already made. The defendant, on the other hand, alleges, That the fact he is charged with

Invention. with cannot, however, come within the intention of the law; since he either could not, or ought not, to have complied with the letter of it in that particular case, which must therefore necessarily be supposed to have been excepted in the design of that law when it was made. But to this the prosecutor may reply, That all such exceptions as are intended by any law, are usually expressed in it: and instances may be brought of particular exceptions expressed in some laws; and if there be any such exception in the law under debate, it should especially be mentioned. He may further add, That to admit of exceptions not expressed in the law itself, is to enervate the force of all laws, by explaining them away, and in effect to render them useless. And this he may further corroborate, by comparing the law under debate with others, and considering its nature and importance, and how far the public interest of the state is concerned in the due and regular execution of it; from whence he may infer, that should exceptions be admitted in other laws of less consequence, yet, however, they ought not in this. Lastly, He may consider the reason alleged by the defendant, on which he founds his plea, and show there was not that necessity of violating the law in the present case, as is pretended. And this is often the more requisite, because the party who disputes against the words of the law, always endeavours to support his allegations from the equity of the case. If, therefore, this plea can be enervated, the main support of the defendant's cause is removed. For as the former arguments are designed to prevail with the judge, to determine the matter on this side the question from the nature of the case; so the intention of this argument is to induce him to it, from the weakness of the defence made by the opposite party. But the defendant will, on the contrary, use such arguments as may best demonstrate the equity of his cause, and endeavour to vindicate the fact from his good design and intention in doing it. He will say, That the laws have allotted punishments for the commission of such facts as are evil in themselves, or prejudicial to others; neither of which can be charged upon the action for which he is accused: That no law can be rightly executed, if more regard be had to the words and syllables of the writing, than to the intention of the legislator. To which purpose, he may allege that direction of the law itself, which says, "The law ought not to be too rigorously interpreted, nor the words of it strained; but the true intention and design of each part of it duly considered." As also that saying of Cicero, "What law may not be weakened and destroyed, if we bend the sense to the words, and do not regard the design and view of the legislator?" Hence he may take occasion to complain of the hardship of such a procedure, that no difference should be made between an audacious and wilful crime, and an honest or necessary action, which might happen to disagree with the letter of the law, though not with the intent of it. And as it was observed before to be of considerable service to the accuser, if he could remove the defendant's plea of equity; so it will be of equal advantage to the defendant, if he can fix upon any words in the law, which may in the least seem to countenance his case, since this will take off the main force of the charge.

The third controversy of this kind is, when two writings happen to clash with each other, or at least seem to do so. Of this Hermogenes gives the following instance. One law enjoins: "He who continues alone in a ship during a tempest, shall have the property of the ship." Another law says, "A disinherited son shall enjoy no part of his father's estate." Now a son, who had been disinherited by his father, happens to be in his father's ship in a tempest, and continues there alone, when every one else had deserted it. He claims the ship by the former of these laws, and his brother tries his right with him by the latter. In such cases, therefore, it may first be considered, "Whether the two laws can be reconciled. And if that cannot be done, then, Which of them appears more equitable. Also, Whether one be positive, and the other negative; because prohibitions are a sort of exceptions to positive injunctions. Or, If one be a general law, and the other more particular, and come nearer to the matter in question. Likewise, Which was last made: since former laws are often abrogated, either wholly or in part, by subsequent laws; or at least were designed to be so. Lastly, It may be observed, Whether one of the laws be not plain and express; and the other more dubious, or has any ambiguity in it. All, or any of which things, that party will not omit to improve for his advantage whose interest is concerned in it."

The fourth controversy is *reasoning*. As when something, not expressly provided for by a law, is inferred by a similitude, or parity of reason, from what is contained in it. Quintilian mentions this instance of it. "There was a law made at Tarentum, to prohibit the exportation of wool; but a certain person exports sheep." In this case, the prosecutor may first compare the thing which occasions the charge, with the words of the law, and show their agreement, and how unnecessary it was that particular thing should have been expressly mentioned in the law, since it is plainly contained in it, or at least an evident consequence from it. He may then plead, that many things of a like nature are omitted in other laws for the same reason. And, lastly, He may urge the reasonableness and equity of the procedure. The defendant, on the other hand, will endeavour to show the deficiency of the reasoning, and the difference between the two cases. He will insist upon the plain and express words of the law, and set forth the ill tendency of such inferences and conclusions drawn from similitudes and comparisons, since there is scarce any thing but in some respect may bear a resemblance to another.

The last controversy under this head is *interpretation*, in which the dispute turns upon the true meaning and explication of the law in reference to that particular case. We have the following instance of this in the Pandects: "A man who had two sons both under age, substitutes Titius as heir to him who should die last, provided both of them died in their minority. They both perish together at sea before they came to age. Here arises a doubt, whether the substitution can take place, or whether the inheritance devolves to the heir at law." The latter pleads, That as neither of them can be said to have died last, the substitution cannot take place; which was suspended, upon the condition that one died after the other. But to this it may be said, It was the intention of the testator, that if both died in their nonage, Titius should

Invention. should succeed to the inheritance; and therefore it makes no difference whether they died together, or one after the other: and so the law determines it.

2. The *second* head of external arguments are *Witnesses*. These may either give their evidence, when absent in writing subscribed with their name; or present by word of mouth. And what both of them testify, may either be from hearsay; or what they saw themselves, and were present at the time it was done. As the weight of the evidence may be thought greater or less on each of these accounts, either party will make such use of it as he finds for his advantage. The characters of the witnesses are also to be considered; and if any thing be found in their lives or behaviour that is justly exceptionable, to invalidate their evidence, it ought not to be omitted. And how they are affected to the contending parties, or either of them, may deserve consideration; for some allowances may be judged reasonable in case of friendship, or enmity, where there is no room for any other exception. But regard should chiefly be had to what they testify, and how far the cause is affected by it. Cicero is very large upon most of these heads in his defence of Marcus Fonteius, with a design to weaken the evidence of the Gauls against him. And where witnesses are produced on one side only, as orators sometimes attempt to lessen the credit of this kind of proof, by pleading that witnesses are liable to be corrupted, or biassed by some prevailing interest or passion, to which arguments taken from the nature and circumstances of things are not subject; it may be answered on the other hand, that sophistical arguments and false colourings are not exposed to infamy or punishment, whereas witnesses are restrained by shame and penalties, nor would the law require them if they were not necessary.

3. The *third* and last head of external arguments are *Contracts*; which may be either public or private. By public are meant the transactions between different states, as leagues, alliances, and the like; which depend on the laws of nations, and come more properly under deliberative discourses, to which we shall refer them. Those are called *private*, which relate to lesser bodies or societies of men, and single persons; and may be either written or verbal. And it is not so much the true meaning and purport of them that is here considered as their force and obligation. And, as the Roman law declares, "Nothing can be more agreeable to human faith, than that persons should stand to their agreements." Therefore in controversies of this kind, the party whose interest it is that the contract should be maintained, will plead, that such covenants have the force of private laws, and ought religiously to be observed, since the common affairs of mankind are transacted in that manner; and therefore to violate them, is to destroy all commerce and society among men. On the other side it may be said, that justice and equity are chiefly to be regarded, which are immutable; and besides, that the public laws are the common rule to determine all differences, which are designed to redress those who are aggrieved. And indeed, where a compact has been obtained by force or fraud, it is in itself void, and has no effect either in law or reason. But on the other hand, the Roman lawyers seem to have very rightly determined, that all such obligations as are founded on natural equity, though not binding by national laws, and are therefore called *nuda pacta*, ought, however, in honour and conscience to be performed.

15
Of the state of a controversy, or the manner of referring the principal question in dispute to some particular head for greater ease of argument.

III. *Of the State of a Controversy.* The ancients, observing that the principal question or point of dispute in all controversies might be referred to some particular head, reduced these heads to a certain number, that both the nature of the question might by that means be better known, and the arguments suited to it be discovered with greater ease. And these heads they call *states*.

By the state of a controversy, then, we are to understand the principal point in dispute between contending parties, upon the proof of which the whole cause or controversy depends. We find it expressed by several other names in ancient writers: as, the *constitution of the cause*, the *general head*, and the *chief question*. And as this is the principal thing to be attended to in every such discourse; so it is what first requires the consideration of the speaker, and should be well fixed and digested in his mind, before he proceeds to look for arguments proper to support it. Thus Antony, the Roman orator, speaking of his own method in his pleading, says: "When I understand the nature of the cause, and begin to consider it, the first thing I endeavour to do is, to settle with myself what that is to which all my discourse relating to the matter in dispute ought to be referred: then I diligently attend to these other two things, How to recommend myself, or those for whom I plead, to the good esteem of my hearers; and how to influence their minds, as may best suit my design." This way of proceeding appears very agreeable to reason and prudence. For what can be more absurd, than for a person to attempt the proof of any thing, before he has well settled in his own mind a clear and distinct notion what the thing is which he would endeavour to prove? Quintilian describes it to be, 'That kind of question which arises from the first conflict of causes.' In judicial cases, it immediately follows upon the charge of the plaintiff, and plea of the defendant. Our common law expresses it by one word, namely the *issue*. Which interpreters explain, by describing it to be, "That point of matter depending in suit, whereupon the parties join, and put their cause to the trial." Examples will further help to illustrate this, and render it more evident. In the cause of Milo, the charge of the Clodian party is, *Milo killed Clodius*. Milo's plea or defence, *I killed him, but justly*. From hence arises this grand question, or state of the cause, *Whether it was lawful for Milo to kill Clodius?* And that Clodius was lawfully killed by Milo, is what Cicero in his defence of Milo principally endeavours to prove. This is the main subject of that fine and beautiful oration. The whole of his discourse is to be considered as centering at last in this one point. Whatever different matters are occasionally mentioned, will, if closely attended to, be found to have been introduced some way or other the better to support and carry on this design. Now in such cases, where the fact is not denied, but something is offered in its defence, the state of the cause is taken from the defendant's plea, who is obliged to make it good: As in the instance here given, the chief point in dispute was the lawfulness of Milo's action, which it was Cicero's business to demonstrate.

Invention. But when the defendant denies the fact, the state of the cause arises from the accusation; the proof of which then lies upon the plaintiff, and not, as in the former case, upon the defendant. So in the cause of Roscius, the charge made against him is, *That he killed his father.* But he denies the fact. The grand question therefore to be argued is, *Whether or not he killed his father?* The proof of this lay upon his accusers. And Cicero's design in his defence of him is to show, that they had not made good their charge. But it sometimes happens, that the defendant neither absolutely denies the fact, nor attempts to justify it; but only endeavours to qualify it, by denying that it is a crime of that nature, or deserves that name, by which it is expressed in the charge. We have an example of this proposed by Cicero: "A person is accused of sacrilege, for taking a thing, that was sacred, out of a private house. He owns the fact, but denies it to be sacrilege; since it was committed in a private house, and not in a temple." Hence this question arises, *Whether to take a sacred thing out of a private house, is to be deemed sacrilege, or only simple theft?* It lies upon the accuser to prove what the other denies; and therefore the state of the cause is here also, as well as in the preceding case, taken from the indictment.

But besides the principal question, there are other subordinate questions, which follow upon it in the course of a dispute, and should be carefully distinguished from it. Particularly that which arises from the reason, or argument, which is brought in proof of the principal question. For the principal question itself proves nothing, but is the thing to be proved, and becomes at last the conclusion of the discourse. Thus, in the cause of Milo, his argument is, *I killed Clodius justly, because he assassinated me.* Unless the Clodian party be supposed to deny this, they give up their cause. From hence therefore this subordinate question follows, *Whether Clodius assassinated Milo?* Now Cicero spends much time in the proof of this, as the hinge on which the first question, and consequently the whole cause, depended. For if this was once made to appear, the lawfulness of Milo's killing Clodius, which was the grand question or thing to be proved, might be inferred as an allowed consequence from it. This will be evident, by throwing Milo's argument, as used by Cicero, into the form of a syllogism.

*An assassin is lawfully killed:*
*Clodius was an assassin:*
*Therefore he was lawfully killed by Milo whom he assassinated.*

If the minor proposition of this syllogism was granted, no one would deny the conclusion: for the Roman law allowed of self-defence. But as Cicero was very sensible this would not be admitted, so he takes much pains to bring the court into the belief of it. Now where the argument brought in defence of the second question is contested, or the orator supposes that it may be so, and therefore supports that with another argument, this occasions a third question consequent upon the former; and in like manner he may proceed to a fourth. But be they more or fewer, they are to be considered but as one chain of subordinate questions dependent upon the first. And though each of them has its particular state, yet none of these is what rhetoricians call *The state of the Cause*, which is to be understood only of the principal question. And if, as it frequently happens, the first or principal question is itself directly proved from more than one argument: this makes no other difference, but that each of these arguments, so far as they are followed by others to support them, become a distinct series of subordinate questions, all dependent upon the first. As when Cicero endeavours to prove, that Roscius did not kill his father, from two reasons or arguments: *Because he had neither any cause to move him to such a barbarous action, nor any opportunity for it.*

Moreover, besides these subordinate questions, there are also incidental ones often introduced, which have some reference to the principal question, and contribute towards the proof of it, though they are not necessarily connected with it, or dependent upon it. And each of these also has its state, though different from that of the cause. For every question, or point of controversy, must be stated, before it can be made the subject of disputation. And it is for this reason, that every new argument advanced by an orator is called a *question*; because it is considered as a fresh matter of controversy. In Cicero's defence of Milo, we meet with several of this sort of questions, occasioned by some aspersions which had been thrown out by the Clodian party to the prejudice of Milo. As, "That he was unworthy to see the light, who owned he had killed a man:" For Milo before his trial had openly confessed he killed Clodius. So likewise, "That the senate had declared the killing of Clodius was an illegal action." And further, "That Pompey, by making a new law to settle the manner of Milo's trial, had given his judgment against Milo." Now to each of these Cicero replies, before he proceeds to the principal question. And therefore, though the question, in which the state of a controversy consists, is said by Quintilian to arise from "the first conflict of causes," yet we find by this instance of Cicero, that it is not always the first question in order, upon which the orator treats.

But it sometimes happens, that the same cause or controversy contains in it more than one state. Thus in judicial causes, every distinct charge occasions a new state. All Cicero's orations against Verres relate to one cause, founded upon a law of the Romans against unjust exactions made by their governors of provinces upon the inhabitants; but as that prosecution is made up of as many charges as there are orations, every charge, or indictment, has its different state. So likewise his oration in defence of Cœlius has two states, in answer to a double charge made against him by his adversaries: one, "for borrowing money of Clodia, in order to bribe certain slaves to kill a foreign ambassador;" and the other, "for an attempt afterwards to poison Clodia herself." Besides which, there were several other matters of a less heinous nature, which had been thrown upon him by his accusers, with a design, very likely, to render the two principal charges more credible; to which Cicero first replies, in the same manner as in his defence of Milo.

Though all the examples we have hitherto brought to illustrate this subject have been taken from judicial

Invention. cases, yet not only these, but very frequently discourses of the deliberative kind, and sometimes those of the demonstrative, are managed in a controversial way. And all controversies have their state. And therefore Quintilian very justly observes, that "states belong both to general and particular questions; and to all sorts of causes, demonstrative, deliberative, and judicial." In Cicero's oration for the Manilian law, this is the main point in dispute between him and those who opposed that law: "Whether Pompey was the fittest person to be intrusted with the management of the war against Mithridates?" This is a subject of the deliberative kind. And of the same nature was that debate in the senate concerning the demolition of Carthage. For the matter in dispute between Cato, who argued for it, and those who were of the contrary opinion, seems to have been this: "Whether it was for the interest of the Romans to demolish Carthage?" And so likewise in those two fine orations of Cato and Cæsar, given us by Sallust, relating to the conspirators with Catiline, who were then in custody, the controversy turns upon this: "Whether those prisoners should be punished with death, or perpetual imprisonment?" Examples of the demonstrative kind are not so common; but Cicero's oration concerning the 'Answers of the soothsayers,' may afford us an instance of it. Several prodigies had lately happened at Rome; upon which the soothsayers being consulted, assigned this as the reason of them, Because some places consecrated to the gods had been afterwards converted to civil uses. Clodius charged this upon Cicero; whose house was rebuilt at the public expence, after it had been demolished by Clodius, and the ground consecrated to the goddess Liberty. Cicero in this oration retorts the charge; and shows that the prodigies did not respect him, but Clodius. So that the question in dispute was, "To which of the two those prodigies related?" This oration does not appear to have been spoken in a judicial way, and must therefore belong to the demonstrative kind. His invective against Piso is likewise much of the same nature, wherein he compares his own behaviour and conduct with that of Piso.

As to the number of these states, both Cicero and Quintilian reduce them to three. "We must (says Quintilian) agree with those whose authority Cicero follows, who tells us, that three things may be inquired into in all disputes: Whether a thing is; what it is; and how it is. And this is the method which nature prescribes. For, in the first place, it is necessary the thing should exist about which the dispute is: because no judgment can be made either of its nature or quality till its existence be manifest; which is therefore the first question. But though it be manifest that a thing is, it does not presently appear what it is; and when this is known, the quality yet remains: and after these three are settled, no further inquiry is necessary." Now the first of these three states is called the *conjectural state*; as if it be inquired, "Whether one person killed another?" This always follows upon the denial of a fact, by one of the parties; as was the case of Roscius. And it receives its name from hence, that the judge is left, as it were, to conjecture, whether the fact was really committed or not, from the evidence produced on the other side. The second is called the *definitive state*, when the fact is not denied; but the dispute turns upon the nature of it, and what name it is proper to give it: as in that example of Cicero, "Whether to take a sacred thing out of a private house be theft or sacrilege?" For in this case it is necessary to settle the distinct notion of those two crimes, and show their difference. The third is called the *state of quality*; when the contending parties are agreed both as to the fact, and the nature of it; but the dispute is, "Whether it be just or unjust, profitable or unprofitable, and the like;" as in the cause of Milo.

From what has been said upon this subject, the use of it may in a good measure appear. For whoever engages in a controversy, ought in the first place to consider with himself the main question in dispute, to fix it well in his mind, and keep it constantly in his view; without which he will be very liable to ramble from the point, and bewilder both himself and his hearers. And it is no less the business of the hearers principally to attend to this; by which means they will be helped to distinguish and separate from the principal question what is only incidental, and to observe how far the principal question is affected by it; to perceive what is offered in proof, and what is only brought in for illustration; not to be misled by digressions, but to discern when the speaker goes off from his subject, and when he returns to it again; and, in a word, to accompany him through the whole discourse, and carry with them the principal chain of reasoning upon which the cause depends, so as to judge upon the whole, whether he has made out his point, and the conclusion follows from the premises.

## Chap. II. *Of Arguments suited to Demonstrative Discourses.*

16 Of arguments suited to demonstrative discourses.

These consist either in praise or dispraise; and, agreeably to the nature of all contraries, one of them will serve to illustrate the other.

Now we either praise *persons* or *things*.

I. In praising or dispraising *persons*, rhetoricians prescribe two methods. One is, to follow the order in which every thing happened that is mentioned in the discourse; the other is, to reduce what is said under certain general heads, without a strict regard to the order of time.

1. In pursuing the former method, the discourse may be very conveniently divided into three periods. The first of which will contain what preceded the person's birth; the second, the whole course of his life; and the third what followed upon his death.

Under the first of these may be comprehended what is proper to be said concerning his country or family. And therefore, if these were honourable, it may be said to his advantage, that he nowise disgraced them, but acted suitably to such a descent. But if they were not so, they may be either wholly omitted; or it may be said, that, instead of deriving thence any advantage to his character, he has conferred a lasting honour upon them; and that it is not of so much moment where, or from whom, a person derives his birth, as how he lives.

In the second period, which is that of his life, the qualities both of his mind and body, with his circumstances in the world, may be separately considered. Though,

Invention. Though, as Quintilian rightly observes, "All external advantages are not praises for themselves, but according to the use that is made of them. For riches, and power, and interest, as they have great influence, and may be applied either to good or bad purposes, are a proof of the temper of our minds; and therefore we are either made better or worse by them." But these things are a just ground for commendation, when they are the reward of virtue or industry. Bodily endowments are health, strength, beauty, activity, and the like; which are more or less commendable, according as they are employed. And where these, or any of them, are wanting, it may be shown, that they are abundantly compensated by the more valuable endowments of the mind. Nay, sometimes a defect in these may give an advantageous turn to a person's character; for any virtue appears greater, in proportion to the disadvantages the person laboured under in exerting it. But the chief topics of praise are taken from the virtues and qualifications of the mind. And here the orator may consider the disposition, education, learning, and several virtues, which shone through the whole course of the person's life. In doing which, the preference should always be given to virtue above knowledge or any other accomplishment. And in actions, those are most considerable, and will be heard with greatest approbation, which a person either did alone, or first, or wherein he had fewest associates; as likewise those which exceeded expectation, or were done for the advantage of others rather than his own. And further, as the last scene of a man's life generally commands the greatest regard, if any thing remarkable at that time was either said or done, it ought particularly to be mentioned. Nor should the manner of his death, or cause of it, if accompanied with any commendable circumstances be omitted; as if he died in the service of his country, or in the pursuit of any other laudable design.

The third and last period relates to what followed after the death of the person. And here the public loss, and public honours conferred upon the deceased, are proper to be mentioned. Sepulchres, statues, and other monuments to perpetuate the memory of the dead, at the expence of the public, were in common use both among the Greeks and Romans. But in the earliest times, as these honours were more rare, so they were less costly. For as in one age it was thought a sufficient reward for him who died in the defence of his country, to have his name cut in a marble inscription, with the cause of his death; so in others it was very common to see the statues of gladiators, and persons of the meanest rank, erected in public places. And therefore a judgment is to be formed of these things from the time, custom, and circumstances, of different nations; since the frequency of them renders them less honourable, and takes off from their evidence as the rewards of virtue. But, as Quintilian says, "Children are an honour to their parents, cities to their founders, laws to those who compiled them, arts to their inventors, and useful customs to the authors of them."

And this may suffice for the method of praising persons, when we propose to follow the order of time, as Isocrates has done in his funeral oration upon Evagoras king of Salamis, and Pliny in his panegyric upon the emperor Trajan. But as this method is Invention. very plain and obvious, so it requires the more agreeable dress to render it delightful; lest otherwise it seem rather like a history than an oration: For which reason, we find, that epic poets, as Homer, Virgil, and others, begin with the middle of their story, and afterwards take a proper occasion to introduce what preceded, to diversify the subject, and give the greater pleasure and entertainment to their readers.

2. The other method above hinted was, to reduce the discourse to certain general heads without regarding the order of time. As if any one, in praising the elder Cato, should propose to do it, by showing that he was a most prudent senator, an excellent orator, and most valiant general; all which commendations are given him by Pliny. In like manner, the character of a good general may be comprised under four heads; skill in military affairs, courage, authority, and success: from all which Cicero commends Pompey. And agreeably to this method Suetonius has written the lives of the first twelve Cæsars.

But in the praising of persons, care should always be taken to say nothing that may seem fictitious or out of character, which may call the orator's judgment or integrity in question. It was not without cause, therefore, that Lysippus the statuary, as Plutarch tells us, blamed Apelles for painting Alexander the Great with thunder in his hand; which could never suit his character as a man, however he might boast of his divine descent: for which reason Lysippus himself made an image of him holding a spear, as the sign of a warrior. Light and trivial things in commendations are likewise to be avoided, and nothing mentioned but what may carry in it the idea of something truly valuable, and which the hearers may be supposed to wish for, and is proper to excite their emulation. These are the principal heads of praise with relation to men. In dispraise, the heads contrary to these are requisite; which being sufficiently clear from what has been said, need not particularly be insisted on.

II. We proceed therefore to the other part of the division, which respects *things*, as distinguished from persons. By which we are to understand all beings inferior to man, whether animate or inanimate; as likewise the habits and dispositions of men, either good or bad, when considered separately, and apart from their subjects, as arts and sciences, virtues and vices, with whatever else may be a proper subject for praise or dispraise. Some writers, indeed, have, for their own amusement and the diversion of others, displayed their eloquence in a jocose manner upon subjects of this kind. So Lucian has written in praise of a fly, and Synesius an elegant encomium upon baldness. Others, on the contrary, have done the like in a satirical way. Such is Seneca's apotheosis or consecration of the emperor Claudius; and the Mysopogon or beard-hater, written by Julian the emperor. Not to mention several modern authors, who have imitated them in such ludicrous compositions. But as to these things, and all of the like nature, the observation of Antony in Cicero seems very just: "That it is not necessary to reduce every subject we discourse upon to rules of art." For many are so trivial, as not to deserve it; and others so plain and evident of themselves, as

as not to require it. But since it frequently comes in the way both of orators and historians to describe countries, cities, and facts, we shall briefly mention the principal heads of invention proper to illustrate each of these.

Countries, then, may be celebrated from the pleasantness of their situation, the clemency and wholesomeness of the air, and goodness of the soil; to which last may be referred the springs, rivers, woods, plains, mountains, and minerals. And to all these may be added their extent, cities, the number and antiquity of the inhabitants; their policy, laws, customs, wealth, character for cultivating the arts both of peace and war; their princes, and other eminent men they have produced. Thus Pacatus has given us a very elegant description of Spain, in his panegyric upon the emperor Theodosius, who was born there.

Cities are praised from much the same topics as countries. And here, whatever contributes either to their defence or ornament ought particularly to be mentioned; as the strength of the walls and fortifications, the beauty and splendour of the buildings, whether sacred or civil, public or private. We have in Herodotus a very fine description of Babylon, which was once the strongest, largest, and most regular city in the world. And Cicero has accurately described the city of Syracuse, in the island Sicily, in one of his orations against Verres.

But facts come much oftener under the cognizance of an orator. And these receive their commendation from their honour, justice, or advantage. But in describing them, all the circumstances should be related in their proper order; and that in the most lively and affecting manner, suited to their different nature. Livy has represented the demolition of Alba by the Roman army, which was sent thither to destroy it, through the whole course of that melancholy scene, in a style so moving and pathetic, that one can hardly forbear condoling with the inhabitants, upon reading his account.

But in discouses of this kind, whether of praise or dispraise, the orator should (as he ought indeed upon all occasions) well consider where, and to whom, he speaks. For wise men often think very differently both of persons and things from the common people. And we find that learned and judicious men are frequently divided in their sentiments, from the several ways of thinking to which they have been accustomed. Besides, different opinions prevail, and gain the ascendant, at different times. While the Romans continued a free nation, love of their country, liberty, and public spirit, were principles in the highest esteem among them. And therefore, when Cato killed himself, that he might not fall into the hands of Cæsar, and survive the liberty of his country, it was thought an instance of the greatest heroic virtue; but afterwards, when they had been accustomed to an arbitrary government, and the spirit of liberty was now lost, the poet Martial could venture to say,

*Death to avoid 'tis madness sure to die.*

A prudent orator therefore will be cautious of opposing any settled and prevailing notions of those to whom he addresses, unless it be necessary; and then he will do it in the softest and most gentle manner.

### Chap. III. *Of Arguments suited to Deliberative Discourses.*

This kind of discourses must certainly have been very ancient; since, doubtless, from the first beginning of men's conversing together, they deliberated upon their common interest, and offered their advice to each other. But neither those of the laudatory nor judicial kind could have been introduced, till mankind were settled in communities, and found it necessary to encourage virtue by public rewards, and bring vice under the restraint of laws. The early practice of suasory discourses appears from sacred writ, where we find, that when Moses was ordered upon an embassy into Egypt, he would have excused himself for want of eloquence. And Homer represents the Greeks at the siege of Troy, as flocking like a swarm of bees to hear their generals harangue them. Nor is this part of oratory less conspicuous for its usefulness to mankind, than for its antiquity; being highly beneficial either in councils, camps, or any societies of men. How many instances have we upon record, where the fury of an enraged multitude has been checked and appeased by the prudent and artful persuasion of some particular person? The story of Agrippa Menenius, when the commons of Rome withdrew from the senators, and retired out of the city, is too well known to need reciting. And how often have armies been animated and fired to the most dangerous exploits, or recalled to their duty, when ready to mutiny, by a moving speech of their general? many instances of which we find in history.

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Of deliberative discourses, and the arguments suited to them.

All deliberation respects something future, for it is in vain to consult about what is already past. The subject matter of it is, either things public or private, sacred or civil; indeed all the valuable concerns of mankind, both present and future, come under its regard. And the end proposed by this kind of discourses is chiefly profit or interest. But since nothing is truly profitable, but what is in some respect good; and every thing which is good in itself may not in all circumstances be for our advantage; properly speaking, what is both good and profitable, or beneficial good, is the end here designed. And therefore, as it sometimes happens, that what appears profitable may seem to interfere with that which is strictly just and honourable; in such cases it is certainly most adviseable to determine on the safer side of honour and justice, notwithstanding some plausible things may be offered to the contrary. But where the dispute lies apparently between what is truly honest, and some external advantage proposed in opposition to it, all good men cannot but agree in favour of honesty. Such was the case of Regulus, who, being taken prisoner by the Carthaginians, was permitted to go to Rome upon giving his oath, that unless he could persuade the senate to set at liberty some young Carthaginian noblemen, then prisoners at Rome, in exchange for him, he should return again to Carthage. But Regulus, when he came to Rome, was so far from endeavouring to prevail with the senate to comply with the desire of the Carthaginians, that he used all his interest to dissuade them from hearkening to the proposal. Nor could the most earnest entreaties of his nearest relations and friends, nor any arguments they were able to offer, engage him to continue at Rome, and not return again

 to Carthage. He had then plainly in his view, on the side, ease, security, affluence, honours, and the enjoyment of his friends; and on the other, certain death, attended with cruel torments. However, thinking the former not consistent with truth and justice, he chose the latter. And he certainly acted as became an honest and brave man, in choosing death, rather than to violate his oath. Though whether he did prudently in persuading the senate not to make the exchange, or they in complying with him, we shall leave others to determine. Now, when it proves to be a matter of debate, whether a thing upon the whole be really beneficial or not; as here arise two parts, advice and dissuasion, they will each require proper heads of argument. But as they are contrary to each other, he who is acquainted with one, cannot well be ignorant of the other. We shall therefore chiefly mention those proper for advice, from whence such as are suited to dissuade will easily be perceived. Now the principal heads of this kind are these following, which are taken from the nature and properties of the thing itself under consideration.

1. *Pleasure* often affords a very cogent argument in discourses of this nature. Every one knows what an influence this has upon the generality of mankind. Though, as Quintilian remarks, pleasure ought not of itself to be proposed as a fit motive for action in serious discourses, but when it is designed to recommend something useful, which is the case here. So, would any one advise another to the pursuit of polite literature, Cicero has furnished him with a very strong inducement to it from the pleasure which attends that study, when he says, "If pleasure only was proposed by these studies, you would think them an entertainment becoming a man of sense and a gentleman. For other pursuits neither agree with all times, all ages, nor all places; but these studies improve youth, delight old age, adorn prosperity, afford a refuge and comfort in adversity, divert us at home, are no hinderance abroad, sleep, travel, and retire with us into the country."

2. *Profit*, or advantage. This has no less influence upon many persons than the former; and when it respects things truly valuable it is a very just and laudable motive. Thus Cicero, when he sends his *Book of Offices* to his son, which he wrote in Latin for his use, advises him to make the best advantage both of his tutor's instructions and the conversation at Athens, where he then was; but withal to peruse his philosophical treatises, which would be doubly useful to him, not only upon account of the subjects, but likewise of the language, as they would enable him to express himself upon those arguments in Latin, which before had only been treated of in Greek.

3. *Honour;* than which no argument will sooner prevail with generous minds, or inspire them with greater ardour. Virgil has very beautifully described Hector's ghost appearing to Æneas the night Troy was taken, and advising him to depart, from this motive of honour:

O goddess-born, escape by timely flight
The flames and horrors of this fatal night.
The foes already have possess'd the wall;
Troy nods from high, and totters to her fall.
Enough is paid to Priam's royal name;
More than enough to duty and to fame.
If by a mortal hand my father's throne
Cou'd be defended, 'twas by mine alone.

The argument here made use of to persuade Æneas to leave Troy immediately, is, that he had done all that could be expected from him, either as a good subject or brave soldier, both for his king and country; which were sufficient to secure his honour: and now there was nothing more to be expected from him when the city was falling, and impossible to be saved; which, could it have been preserved by human power, he himself had done it.

But although a thing considered in itself appear beneficial if it could be attained, yet the expediency of undertaking it may still be questionable: in which case the following heads, taken from the circumstances which attend it, will afford proper arguments to engage in it.

(1.) The *possibility* of succeeding may sometimes be argued, as one motive to this end. So Hannibal endeavoured to convince King Antiochus, that it was possible for him to conquer the Romans, if he made Italy the seat of the war; by observing to him, not only that the Gauls had formerly destroyed their city, but that he had himself defeated them in every battle he fought with them in that country.

(2.) But an argument founded upon *probability* will be much more likely to prevail. For in many affairs of human life, men are determined either to prosecute them or not, as the prospect of success appears more or less probable. Hence Cicero, after the fatal battle at Pharsalia, dissuades those of Pompey's party, with whom he was engaged, from continuing the war any longer against Cæsar; because it was highly improbable, after such a defeat, by which their main strength was broken, that they should be able to stand their ground, or meet with better success than they had before.

(3.) But further, since probability is not a motive strong enough with many persons to engage in the prosecution of a thing which is attended with considerable difficulties, it is often necessary to represent the facility of doing it, as a further reason to induce them to it. And therefore Cicero makes use of this argument to encourage the Roman citizens in opposing Mark Antony (who upon the death of Cæsar had assumed an arbitrary power), by representing to them, that his circumstances were then desperate, and that he might easily be vanquished.

(4.) Again, If the thing advised can be shown to be in any respect necessary, this will render the motive still much stronger for undertaking it. And therefore Cicero joins this argument with the former, to prevail with the Roman citizens to oppose Antony, by telling them, that "The consideration before them was, not in what circumstances they should live, but whether they should live at all, or die with ignominy and disgrace." This way of reasoning will sometimes prevail when all others prove ineffectual. For some persons are not to be moved till things are brought to an extremity, and they find themselves reduced to the utmost danger.

(5.) To these heads may be added the considera-tion

Invention. tion of the *event*, which in some cases carries great weight with it. As when we advise to the doing of a thing from this motive, That whether it succeed or not, it will yet be of service to undertake it. So after the great victory gained by Themistocles over the Persian fleet at the straits of Salamis, Mardonius advised Xerxes to return into Asia himself, lest the report of his defeat should occasion an insurrection in his absence: but to leave behind him an army of 300,000 men under his command; with which, if he should conquer Greece, the chief glory of the conquest would redound to Xerxes; but if the design miscarried, the disgrace would fall upon his generals.

These are the principal heads which furnish the orator with proper arguments in giving advice. Cicero, in his oration for the Manilian law, where he endeavours to persuade the Roman people to choose Pompey for their general in the Mithridatic war, reasons from three of these topics, into which he divides his whole discourse; namely, the necessity of the war, the greatness of it, and the choice of a proper general.—Under the first of these he shows, that the war was necessary, from four considerations; the honour of the Roman state, the safety of their allies, their own revenues, and the fortunes of many of their fellow citizens, which were all highly concerned in it, and called upon them to put a stop to the growing power of King Mithridates, by which they were all greatly endangered. So that this argument is taken from the head of *necessity*. The second, in which he treats of the greatness of the war, is founded upon the topic of *possibility*. For though he shews the power of Mithridates to be very great, yet not so formidable, but that he might be subdued; as was evident from the many advantages Lucullus had gained over him and his associates. In the third head, he endeavours to prevail with them to intrust the management of the war in the hands of Pompey, whom he describes as a consummate general, for his skill in military affairs, courage, authority, and success; in all which qualities he represents him as superior to any other of their generals whom they could at that time make choice of. The design of all which was, to persuade them, that the had very good reason to hope for success, and a happy event of the war, under his conduct. So that they whole force of his reasoning under this head is drawn from *probability*. These are the three general topics which make up that fine discourse. Each of which is indeed supported by divers other arguments and considerations, which will be obvious in perusing the oration itself, and therefore need not be here enumerated. On the contrary, in another oration he endeavours to dissuade the senate from consenting to a peace with Mark Antony, because it was base, dangerous, and impracticable.

But no small skill and address are required in giving advice. For since the tempers and sentiments of mankind, as well as their circumstances, are very different and various; it is often necessary to accommodate the discourse to their inclinations and opinions of things. And therefore the weightiest arguments are not always the most proper and fittest to be used on all occasions. Cicero, who was an admirable master of this art, and knew perfectly well how to suit what he said to the taste and relish of his hearers, in treating upon this subject, distinguishes mankind into two sorts; the ignorant and unpolished, who always prefer profit to honour; and such as are more civilized and polite, who prefer honour and reputation to all other things.—Wherefore they are to be moved by these different views: Praise, glory, and virtue, influence the one; while the other is only to be engaged by a prospect of gain and pleasure. Besides, it is plain, that the generality are much more inclined to avoid evils than to pursue what is good; and to keep clear of scandal and disgrace, than to practise what is truly generous and noble. Persons likewise of a different age act from different principles; young men for the most part view things in a different light from those who are older and have had more experience, and consequently are not to be influenced by the same motives.

## Chap. IV. *Of Arguments suited to Judicial Discourses.*

18 Of judicial discourses, and the arguments suited to them.

In *judicial* controversies there are two parties; the plaintiff or prosecutor, and the defendant or person charged. The subject of them is always something past. And the end proposed by them Cicero calls *equity*, or *right* and *equity*; the former of which arises from the laws of the country, and the latter from reason and the nature of things. For at Rome the prætors had a court of equity, and were empowered, in many cases relating to property, to relax the rigour of the written laws. But as this subject is very copious, and causes may arise from a great variety of things, writers have reduced them to three heads, which they call *states*, to some one of which all judicial proceedings may be referred; namely, *whether a thing is*, *what it is*, or *how it is*. By the *state* of a cause therefore is meant the principal question in dispute, upon which the whole affair depends. Which, if it stops in the first inquiry, and the defendant denies the fact, the state is called *conjectural*; but if the fact be acknowledged, and yet denied to be what the adversary calls it, it is termed *definitive*; but if there is no dispute either about the fact or its name, but only the justice of it, it is called the *state of quality*: as was shown more largely before (see N° 15.) But we there considered these states only in a general view, and deferred the particular heads of argument proper for each of them to this *judicial* kind of discourses; where they most frequently occur, and from which examples may easily be accommodated to other subjects.

All judicial causes are either *private* or *public*. Those are called *private*, which relate to the right of particular persons; and they are likewise called *civil* causes, as they are conversant about matters of property.—*Public* causes are those which relate to public justice and the government of the state: which are also called *criminal*, because by them crimes are prosecuted, whether capital, or those of a less heinous nature. We shall take the heads of the arguments only from this latter kind, because they are more copious, and easy to be illustrated by examples; from which such as agree to the former, namely, *civil* causes, will sufficiently appear.

1. The *conjectural* state. When the accused person denies

Invention. denies the fact, there are three things which the prosecutor has to consider; whether he *would* have done it, whether he *could*, and whether he *did* it. And hence arise three topics; from the *will*, the *power*, and the *signs* or circumstances which attended the action. The affections of the mind discover the will; as, passion, an old grudge, a desire of revenge, a resentment of an injury, and the like. Therefore Cicero argues from Clodius's hatred of Milo, that he designed his death; and from thence infers, that he was the aggressor in the combat between them, wherein Clodius was killed. This is what he principally endeavours to prove, and comes properly under this state: for Milo owned that he killed him, but alleged that he did it in his own defence. So that in regard to this point, Which of them assaulted the other? the charge was mutual. The prospect of advantage may also be alleged to the same purpose. Hence it is said of L. Cassius, that whenever he sat as judge in a case of murder, he used to advise and move the court to examine to whom the advantage arose from the death of the deceased. And Cicero puts this to Antony concerning the death of Cæsar. "If any one (says he) should bring you upon trial, and use that saying of Cassius, *Cui bono?* 'Who got by it?' look to it, I beseech you, that you are not confounded." To these arguments may be added, hope of impunity, taken either from the circumstances of the accused person, or of him who suffered the injury. For persons, who have the advantage of interest, friends, power, or money, are apt to think they may easily escape; as likewise such who have formerly committed other crimes with impunity. Thus Cicero represents Clodius as hardened in vice, and above all the restraint of laws, from having so often escaped punishment upon committing the highest crimes. On the contrary, such a confidence is sometimes raised from the condition of the injured party, if he is indigent, obscure, timorous, or destitute of friends; much more if he has an ill reputation, or is loaded with popular hatred and resentment. It was this presumption of the obscurity of Roscius, who lived in the country, and his want of interest at Rome, which encouraged his accusers to charge him with killing his father, as Cicero shows in his defence of him. Lastly, The temper of a person, his views, and manner of life, are considerations of great moment in this matter. For persons of bad morals, and such as are addicted to vice, are easily thought capable of committing any wickedness. Hence Sallust argues from the evil disposition and vicious life of Catiline, that he affected to raise himself upon the ruins of his country.—The second head is the *power* of doing a thing: and there are three things which relate to this, the *place*, the *time*, and *opportunity*. As if a crime is said to have been committed in a private place, where no other person was present; or in the night; or when the injured person was unable to provide for his defence. Under this head may likewise be brought in the circumstances of the persons; as if the accused person was stronger, and so able to overpower the other; or more active, and so could easily make his escape. Cicero makes great use of this topic in the case of Milo, and shows, that Clodius had all the advantages of *place*, *time*, and *opportunity*, to execute his design of killing him. The third head comprehends Invention. the *signs* and circumstances which either preceded, accompanied, or followed, the commission of the fact. So threats, or the accused person being seen at or near the place before the fact was committed, are circumstances that may probably precede murder; fighting, crying out, bloodshed, are such as accompany it; paleness, trembling, inconsistent answers, hesitation, or faltering of the speech, something found upon the person accused which belonged to the deceased, are such as follow it. Thus Cicero proves, that Clodius had threatened the death of Milo, and given out that he should not live above three days at the farthest.—These arguments, taken from conjectures, are called *presumptions*, which, though they do not directly prove that the accused person committed the fact with which he is charged; yet when laid together, they appeared very strong, sentence by the Roman law might sometimes be given upon them, to convict him.

These are the topics from which the prosecutor takes his arguments. Now the business of the defendant is to invalidate these. Therefore such as are brought from the *will*, he either endeavours to show are not true, or so weak as to merit very little regard. And he refutes those taken from the *power*, by proving that he wanted either opportunity or ability: as, if he can show, that neither the place nor time insisted on was at all proper; or that he was then in another place. In like manner he will endeavour to confute the *circumstances*, if they cannot be directly denied, by showing that they are not such as do necessarily accompany the fact, but might have proceeded from other causes, though nothing of what is alleged had been committed; and it will be of great service to assign some other probable cause. But sometimes the defendant does not only deny that he did the fact, but charges it upon another. Thus Cicero, in his oration for Roscius, not only defends him from each of these three heads, but likewise charges the fact upon his accusers.

2. The *definitive* state, which is principally concerned in defining and fixing the name proper to the fact: though orators seldom make use of exact definitions, but commonly choose larger descriptions, taken from various properties of the subject or thing described.

The heads of argument in this state are much the same to both parties, For each of them defines the fact his own way, and endeavours to refute the other's definition. We may illustrate this by an example from Quintilian: "A person is accused of sacrilege, for stealing money out of a temple, which belonged to a private person." The fact is owned; but the question is, *Whether it be properly sacrilege?* The prosecutor calls it so, because it was taken out of a temple. But since the money belonged to a private person, the defendant denies it to be sacrilege, and says it is only simple theft. Now the reason why the defendant uses this plea, and insists upon the distinction, is, because by the Roman law the penalty of theft was only four times the value of what was stolen; whereas sacrilege was punished with death. The prosecutor then forms his definition agreeable to his charge, and says, "To steal any thing out of a sacred place is sacrilege." But the defendant excepts against this definition,

Invention. definition, as defective; and urges, that it does not amount to ſacrilege, unleſs the thing ſtolen was likewiſe ſacred. And this caſe might once, perhaps, have been a matter of controverſy, ſince we find it expreſsly determined in the Pandects, that "An action of ſacrilege ſhould not lie, but only of theft, againſt any one who ſhould ſteal the goods of private perſons depoſited in a temple."

The ſecond thing is the proof brought by each party to ſupport his definition; as in the example given us by Cicero, of one "who carried his cauſe by bribery, and was afterwards proſecuted again upon an action of prevarication." Now, if the defendant was caſt upon this action, he was, by the Roman law, ſubjected to the penalty of the former proſecution. Here the proſecutor defines prevarication to be, *Any bribery or corruption in the defendant, with a deſign to pervert juſtice.* The defendant, therefore, on the other hand, reſtrains it to *bribing only the proſecutor.*

And if this latter ſenſe agrees better with the common acceptation of the word, the proſecutor in the third place pleads the intention of the law, which was to comprehend all bribery in judicial matters under the term of *prevarication.* In anſwer to which the defendant endeavours to ſhow, either from the head of contraries, that a real proſecutor and a prevaricator are uſed as oppoſite terms in the law; or from the etymology of the word, that a prevaricator denotes one who pretends to appear in the proſecution of a cauſe, while in reality he favours the contrary ſide; and conſequently, that money given for this end only can, in the ſenſe of the law, be called *prevarication.*

Laſtly, The proſecutor pleads, that it is unreaſonable that he who does not deny the fact ſhould eſcape by a cavil about a word. But the defendant inſiſts upon his explication as agreeable to the law; and ſays, the fact is miſrepreſented and blackened, by affixing to it a wrong name.

3. The third ſtate is that of *quality,* in which the diſpute turns upon the juſtice of an action. And here the defendant does not deny he did the thing he is charged with; but aſſerts it to be right and equitable, from the circumſtances of the caſe, and the motives which induced him to it.

And, firſt, He ſometimes alleges, the reaſon of doing it was in order to prevent ſome other thing of worſe conſequence, which would otherwiſe have happened. We have an inſtance of this in the life of Epaminondas, who, with two other generals joined in the command with him, marched the Theban army into Peloponneſus againſt the Lacedemonians; but by the influence of a contrary faction at home, their commiſſions were ſuperſeded, and other generals ſent to command the army. But Epaminondas, being ſenſible that, if he obeyed this order at that time, it would be attended with the loſs of the whole army, and conſequently the ruin of the ſtate, refuſed to do it; and having perſuaded the other generals to do the like, they happily finiſhed the war in which they were engaged; and upon their return home, Epaminondas taking the whole matter upon himſelf, on his trial was acquitted. The arguments proper in this caſe are taken from the juſtice, uſefulneſs, or neceſſity, of the action. The accuſer therefore will plead, that the fact was not juſt, profitable, nor neceſſary, conſidered either in itſelf or comparatively with that for the ſake of which it is ſaid to have been done: and he will endeavour to ſhow, that what the defendant aſſigns for the reaſon of what he did might not have happened as he pretends. Beſides, he will repreſent of what ill conſequence it muſt be, if ſuch crimes go unpuniſhed. The defendant, on the other hand, will argue from the ſame heads, and endeavour to prove the fact was juſt, uſeful, or neceſſary. And he will further urge, that no juſt eſtimate can be made of any action, but from the circumſtances which attend it; as the deſign, occaſion, and motives for doing it, which he will repreſent in the moſt favourable light to his own cauſe, and endeavour to ſet them in ſuch a view, as to induce others to think they could not but have done the ſame in the like circumſtances.

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Again, The cauſe of an action is ſometimes charged by the defendant upon the party who received the damage, or ſome other perſon, who either made it neceſſary, or enjoined him to do it. The firſt of theſe was Milo's plea for killing Clodius, becauſe he aſſaulted him with a deſign to take away his life. Here the fact is not denied, as in the caſe of Roſcius above-mentioned, under the *conjectural* ſtate; but juſtified from the reaſon of doing it. For that an aſſaſſin might be juſtly killed, Cicero ſhows both from law and reaſon The accuſer, therefore, in ſuch a caſe, will, if there be room for it, deny the truth of this allegation. So the friends of Clodius affirmed that Milo was the aggreſſor, and not Clodius; which Cicero, in his defence of Milo, principally labours to refute. In the ſecond caſe, the proſecutor will ſay, No one ought to offend becauſe another has offended firſt; which defeats the courſe of public juſtice, renders the laws uſeleſs, and deſtroys the authority of the magiſtrate. The defendant, on the other hand, will endeavour to repreſent the danger and neceſſity of the caſe, which required an immediate remedy, and in that manner; and urges, that it was vain and impracticable to wait for redreſs in the ordinary way, and therefore no ill conſequence can ariſe to the public. Thus Cicero, in defending Sextius, who was proſecuted for a riot in bringing armed men into the forum, ſhows that his deſign was only to repel force with force; which was then neceſſary, there being no other means left for the people to aſſemble, who were excluded by a mob of the contrary party. Of the third caſe we have alſo an example in Cicero, who tells us, that, "in making a league between the Romans and Samnites, a certain young nobleman was ordered by the Roman general to hold the ſwine (deſigned for a ſacrifice); but the ſenate afterwards diſapproving the terms, and delivering up their general to the Samnites, it was moved, Whether this young man ought not likewiſe to be given up." Thoſe who were for it might ſay, that, to allege the command of another, is not a ſufficient plea for doing an ill action; and this is what the Roman law now expreſsly declares. But in anſwer to that, it might be replied, that it was his duty to obey the command of his general, who was anſwerable for his own orders, and not thoſe who were obliged to execute them; and therefore, to

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give up this young nobleman would be to punish one person for the fault of another.

Lastly, A fact is sometimes rather excused than defended, by pleading that it was not done designedly, or with any ill intent. This is called *concession;* and consists of two parts, *apology* and *entreaty*. The former represents the matter as the effect of inadvertency, chance, or necessity. Aristotle gives us an example of inadvertency or imprudence in a woman at Athens, who gave a young man a love potion, which killed him; for which she was tried, but acquitted: though afterwards this was made criminal by the Roman law. The case of Adrastus, as related by Herodotus, is an instance of chance; who being intrusted by Crœsus with the care of his son, as they were hunting, killed him accidentally with a javelin which he threw at a boar. It is necessity, when a person excuses his making a default, from stress of weather, sickness, or the like. Thus Cicero pleaded his illness, contracted by the fatigue of a long journey, as an excuse for not appearing in the senate upon the summons of Mark Antony, who threatened to oblige him to it by pulling his house down. But what the defendant here attributes to inadvertency, chance, or necessity, the opposite party will attribute to design, negligence, or some other culpable reason; and represent it as a matter injurious to the public to introduce such precedents; and also produce instances, if that can be done, where the like excuses have not been admitted. On the other hand, the defendant will insist on his innocence, and show the hardship and severity of judging men's actions rather by the event, than from the intention: that such a procedure makes no difference between the innocent and the guilty; but must necessarily involve many honest men in ruin and destruction, discourage all virtuous and generous designs, and turn greatly to the prejudice of human society. He will also consider the instances alleged by the accuser, and show the difference between them and his own case. And, lastly, He will have recourse to entreaty, or a submissive address to the equity and clemency of the court, or party offended, for pardon; as Cicero has done in his oration to Cæsar, in favour of Ligarius.

## Chap. V. *Of the Character and Address of an Orator.*

19 Propriety of manners necessary in an orator, both with respect to character and address.

Having considered and explained the first part of Invention, which furnish the orator with such arguments as are necessary for the proof of his subject, we are next to show what are the proper means to conciliate the minds of his hearers; to gain their affection; and to recommend both himself, and what he says, to their good opinion and esteem. For the parts of invention are commonly thus distinguished; that the first respects the *subject* of the discourse, the second the *speaker*, and the third the *hearers*. Now the second of these, what we have at present to explain, is by Quintilian called a *propriety of manners*. And in order to express this it is necessary, as he tells us, "that every thing appear easy and natural, and the disposition of the speaker be discovered by his words." We may form an easy conception of this from the conduct of such persons as are most nearly concerned in each others welfare. As when relations or friends converse together upon any affairs of importance, the temper and disposition of the speaker plainly shows itself by his words and manner of address. And what nature here directs to without colouring or disguise, the orator is to endeavour to perform by his art. Though indeed, if what a person says be inconsistent with his usual conduct and behaviour at other times, he cannot expect it should gain much credit, or make any deep impression upon his hearers; which may be one reason why the ancient rhetoricians make it so necessary a qualification in an orator, that he be a good man; since he should always be consistent with himself, and, as we say, talk in character. And therefore it is highly requisite, that he should not only gain the skill of assuming those qualities which the nature and circumstances of his discourse require him to express; but likewise, that he should use his utmost endeavours to get the real habits implanted in his mind. For as by this means they will be always expressed with greater ease and facility; so, by appearing constantly in the course of his life, they will have more weight and influence upon particular occasions.

Now there are four qualities, more especially suited to the character of an orator, which should always appear in his discourses, in order to render what he says acceptable to his hearers; and these are, *wisdom*, *integrity*, *benevolence*, and *modesty*.

1. *Wisdom* is necessary; because we easily give into those whom we esteem wiser and more knowing than ourselves. Knowledge is very agreeable and pleasant to all, but few make very great improvements in it; either by reason they are employed in other necessary affairs, and the mind of man cannot attend to many things at once; or because the way to knowledge at first is hard and difficult, so that persons either do not care to enter upon the pursuit of it, or, if they do, they are many times soon discouraged, and drop it, for want of sufficient resolution to surmount its difficulties. Such, therefore, as either cannot, or do not care to themselves the trouble of examining into things themselves, must take up with the representation of others; and it is an ease to them to hear the opinion of persons whom they esteem wiser then themselves. No one loves to be deceived; and those who are fearful of being misled, are pleased to meet with a person in whose wisdom, as they think, they can safely trust. The character of wisdom therefore is of great service to an orator, since the greater part of mankind are swayed by authority rather than arguments.

2. But this of itself is not sufficient, unless the opinion of *integrity* be joined with it. Nay, so far from it, that the greater knowledge and understanding a man is supposed to have, unless he likewise have the character of an honest man, he is often the more suspected. For knowledge without honesty, is generally thought to dispose a person, as well as qualify him, to deceive.

3. And to both these qualities the appearance of kindness and *benevolence* should likewise be added. For though a person have the reputation of wisdom and honesty, yet if we apprehend he is either not well affected to us, or at least regardless of our interest, we are in many cases apt to be jealous of him. Mankind are naturally swayed by their affections, and much influenced

fluenced through love or friendship; and therefore nothing has a greater tendency to induce persons to credit what is said, than intimations of affection and kindness. The best orators have been always sensible what great influence the expressions of kindness and benevolence have upon the minds of others, to induce them to believe the truth of what they say; and therefore they frequently endeavour to impress them with the opinion of it. Thus Demosthenes begins his celebrated oration for Ctesiphon. "It is my hearty prayer (says he) to all the deities, that this my defence may be received by you with the same affection which I have always expressed for you and your city." And it is a very fine image of it which we have in Cicero, where, in order to influence the judges in favour of Milo, he introduces him speaking thus, as became a brave man, and a patriot, even upon the supposition he should be condemned by them: "I bid my fellow citizens adieu: may they continue flourishing and prosperous; may this famous city be preserved, my most dear country, however it has treated me; may my fellow citizens enjoy peace and tranquillity without me, since I am not to enjoy it with them, though I have procured it for them: I will withdraw, I will be gone."

4. *Modesty*. It is certain, that what is modestly spoken is generally better received than what carries in it an air of boldness and confidence. Most persons, though ignorant of a thing, do not care to be thought so; and would have some deference paid to their understanding. But he who delivers himself in an arrogant and affirming way seems to upbraid his hearers with ignorance, while he does not leave them to judge for themselves, but dictates to them, and as it were demands their assent to what he says; which is certainly a very improper method to win upon them. For not a few, when convinced of an error in such a way, will not own it; but will rather adhere to their former opinion, than seem forced to think right, when he gives another the opportunity of a triumph. A prudent orator therefore will behave himself with modesty, that he may not seem to insult his hearers; and will lay things before them in such an engaging manner, as may remove all prejudice either from his person or what he asserts. This is particularly necessary in the exordium of a discourse. If the orator set out with an air of arrogance and ostentation, the self-love and pride of the hearers will be presently awakened, and will follow him with a very suspicious eye throughout all his progress. His modesty should discover itself not only in his expressions at the beginning, but in his whole manner; in his looks, in his gestures, in the tone of his voice. Every auditory take in good part those marks of respect and awe, which are paid to them by one who addresses them. Indeed the modesty of an introduction should never betray any thing mean or abject. It is always of great use to an orator, that together with modesty and deference to his hearers, he should show a certain sense of dignity, arising from a persuasion of the justice or importance of the subject on which he is to speak. For to speak timorously, and with hesitation, destroys the credit of what is offered; and so far as the speaker seems to distrust what he says himself, he often induces others to do the like.

But, as has been said already, great care is to be taken that these characters do not appear feigned and counterfeit. For what is fictitious can seldom be long concealed. And if this be once discovered, it makes all that is said suspected, how specious soever it may otherwise appear.

It is further necessary, that the orator should know the world, and be well acquainted with the different tempers and dispositions of mankind. Nor indeed can any one reasonably hope to succeed in this province, without well considering the circumstances of time and place, with the sentiments and dispositions of those to whom he speaks; which, according to Aristotle, may be distinguished four ways, as they discover themselves by the several *affections*, *habits*, *ages*, and *fortunes* of mankind. And each of these require a different conduct and manner of address.

The *affections* denote certain emotions of the mind, which, during their continuance, give a great turn to the disposition. For love prompts to one thing, and hatred to another. The like may be said of anger, lenity, and the rest of them.

Persons differ likewise according to the various *habits* of their mind. So a just man is inclined one way, and an unjust man another; a temperate man to this, and an intemperate man to the contrary.

And as to the several *ages* of men, Aristotle has described them very accurately; and how persons are differently affected in each of them. He divides the lives of men, considered as hearers, into three stages; youth, middle age, and old age.—Young men, he says, have generally strong passions, and are very eager to obtain what they desire; but are likewise very mutable, so that the same thing does not please them long. They are ambitious of praise, and quick in their resentments: lavish of their money, as not having experienced the want of it: frank and open, because they have not often been deceived; and credulous for the same reason. They readily hope the best, because they have not suffered much, and are therefore not so sensible of the uncertainty of human affairs; for which reason they are likewise more easily deceived. They are modest, from their little acquaintance with the world. They love company and cheerfulness, from the briskness of their spirits. In a word, they generally exceed in what they do; love violently, hate violently, and act in the same manner through the rest of their conduct.—The disposition of old men is generally contrary to the former. They are cautious, and enter upon nothing hastily; having in the course of many years been often imposed upon; having often erred, and experienced the prevailing corruption of human affairs; for which reason they are likewise suspicious, and moderate in their affections either of love or hatred. They pursue nothing great and noble, and regard only the necessaries of life. They love money; having learned by experience the difficulty of getting it, and how easily it is lost. They are fearful, which makes them provident. Commonly full of complaints, from bodily infirmities, and a deficiency of spirits. They please themselves rather with the memory of what is past, than with any future prospect; having so short a view of life before them, in comparison of what is already gone: for which reason also, they love to talk of things past; and prefer them

Invention. them to what is present, of which they have but little relish, and know they must shortly leave them. They are soon angry, but not to excess. Lastly, They are compassionate, from a sense of their own infirmities, which makes them think themselves of all persons most exposed.—Persons of a middle age, betwixt these two extremes, as they are freed from the rashness and temerity of youth, so they have not yet suffered the decays of old age. Hence in every-thing they generally observe a better conduct. They are neither so hasty in their assent as the one, nor so minutely scrupulous as the other, but weigh the reasons of things. They regard a decency in their actions; are careful and industrious; and as they undertake what appears just and laudable upon better and more deliberate consideration than young persons, so they pursue them with more vigour and resolution than those who are older.

As to the different *fortunes* of mankind, they may be considered as noble, rich, or powerful; and the contrary to these.—Those of high birth, and noble extraction, are generally very tender of their honour, and ambitious to increase it; it being natural for all persons to desire an addition to those advantages of which they find themselves already possessed. And they are apt to consider all others as much their inferiors, and therefore expect great regard and deference should be shown them.—Riches, when accompanied with a generous temper, command respect from the opportunities they give of being useful to others; but they usually elate the mind, and occasion pride. For as money is commonly said to command all things, those who are possessed of a large share of it, expect others should be at their beck: since they enjoy that which all desire, and which most persons make the main pursuit of their lives to obtain.—But nothing is more apt to swell the mind than power. This is what all men naturally covet, even when perhaps they would not use it. But the views of such persons are generally more noble and generous than of those who only pursue riches and the heaping up of money. A state contrary to these gives a contrary turn of mind; and in lower life, persons dispositions usually differ according to their station and circumstances. A citizen and a courtier, a merchant and a soldier, a scholar and a peasant, as their pursuits are different, so is generally their turn and disposition of mind.

It is the orator's business, therefore, to consider these several characters and circumstances of life, with the different bias and way of thinking they give to the mind; that he may so conduct himself in his behaviour and manner of speaking, as will render him most acceptable, and gain him the good esteem of those whom he addresses.

## Chap. VI. *Of the Passions.*

20
It is necessary, though difficult, to engage the interest of the passions.

As it is often highly necessary for the orator, so it requires his greatest skill, to engage the passions in his interest. Quintilian calls this *the soul and spirit of his art.* And, doubtless, nothing more discovers its empire over the minds of men, than this power to excite, appease, and sway their passions, agreeably to the design of the speaker. Hence we meet with the characters of *admirable*, *divine*, and other splendid titles, ascribed to eloquence by ancient writers. It has indeed been objected by some, that whatever high encomiums may be given of this art by the admirers of it, it is however disingenuous to deceive and impose upon mankind, as those seem to do, who, by engaging their passions, give a bias to their minds, and take them off from the consideration of the truth; whereas every thing should be judged of from the reasons brought to support it, by the evidence of which it ought to stand or fall. But in answer to this, it may be considered that all fallacy is not culpable. We often deceive children for their good; and physicians sometimes impose on their patients, to come at a cure. And why, therefore, when persons will not be prevailed with by reason and argument, may not an orator endeavour, by engaging their passions, to persuade them to that which is for their advantage? Besides, Quintilian makes it a necessary qualification of an orator, that he be an honest man, and one who will not abuse his art. But since those of a contrary character will leave no methods untried in order to carry their point, it is requisite for those who design well to be acquainted with all their arts, without which they will not be a match for them; as in military affairs it is highly advantageous for the general of an army to get himself informed of all the designs and stratagems of the enemy, in order to counteract them. Indeed this part of oratory is not necessary at all times, nor in all places. The better prepared persons are to consider truth, and act upon the evidence of it, the less occasion there appears for it. But the greater part of mankind, either do not duly weigh the force of arguments, or refuse to act agreeably to their evidence. And where this is the case, that persons will neither be convinced by reason, nor moved by the authority of the speaker, the only way left to put them upon action, is to engage their passions. For the passions are to the mind, what the wind is to a ship: they move, and carry it forward; and he who is without them, is in a manner without action, dull and lifeless. There is nothing great or noble to be performed in life, wherein the passions are not concerned. The Stoics, therefore, who were for eradicating the passions, both maintained a thing in itself impossible, and which, if it was possible, would be of the greatest prejudice to mankind. For while they appeared such zealous assertors of the government of reason, they scarce left it any thing to govern; for the authority of reason is principally exercised in ruling and moderating the passions, which, when kept in a due regulation, are the springs and motives to virtue. Thus hope produces patience, and fear industry; and the like might be shown of the rest. The passions therefore are not to be extirpated, as the Stoics asserted, but put under the direction and conduct of reason. Indeed where they are ungovernable, and resist the controul of reason, they are, as some have fitly called them, *diseases of the mind;* and frequently hurry men into vice, and the greatest misfortunes of life: just as the wind, when it blows moderately, carries on the ship; but if it be too boisterous and violent, may overset her. The charge therefore brought against this art, for giving rules to influence the passions, appears groundless and unjust; since the proper use of the passions is, not to hinder the exercise

exercise of reason, but engage men to act agreeably to reason. And if an ill use be sometimes made of this, it is not the fault of the art but of the artist.

We shall here consider the passions, as they may be separately referred, either to *demonstrative*, *deliberative*, or *judicial* discourses; though they are not wholly confined to any of them.

21 Of the passions which may be referred to demonstrative discourses.

1. To the *demonstrative* kind, we may refer *joy* and *sorrow*, *love* and *hatred*, *emulation* and *contempt*.

*Joy* is an elation of the mind, arising from a sense of some present good. Such a reflection naturally creates a pleasant and agreeable sensation, which ends in a delightful calm and serenity. This is heightened by a description of former evils, and a comparison between them and the present felicity. Thus Cicero endeavours to excite in the minds of his fellow citizens the highest sense of joy and delight at Catiline's departure from Rome, by representing to them the imminent danger which threatened both them and the city while he continued among them.

*Sorrow*, on the contrary, is an uneasiness of mind arising from a sense of some present evil. This passion has generally a place in funeral discourses. And it may be heightened, like the former, by comparison, when any past happiness is set in opposition to a present calamity. Hence Cicero aggravates the sorrow at Rome occasioned by the death of Metellus, from his character, and great services to the public, while living.

*Love* excites us to esteem any person for some excellency, and to do him all the good in our power. It is distinguished from *friendship*, which is mutual; and therefore love may continue where friendship is lost; that is, the affection may remain on one side. And when we assist a person from no other [illegible]ive but to do him a kindness, Aristotle calls this *good will*. Love takes its rise from a variety of causes. Generosity, benevolence, integrity, gratitude, courtesy, and other social virtues, are great incitements to love any one endued with such qualities. And persons generally love those who are of a like disposition with themselves and pursue the same views. It is therefore the chi[illegible] of a flatterer to suit himself in every thing to th[illegible]ation of the person whose good graces he courts. When the orator would excite this affection towards any person, it is proper to show, that he is possessed of at least some, if not all, of these agreeable qualities. When the conspirators with Catiline were to be brought to justice, Cicero was very sensible of the envy he should contract on that account, and how necessary it was for him to secure the love of the Roman senate for his support and protection in that critical juncture. And this he endeavours to do in his fourth oration against Catiline, by representing to them in the most pathetic manner, that all the labours he underwent, the difficulties he conflicted with, and the dangers to which he was exposed on that account, were not for his own sake, but for their safety, quiet, and happiness.

*Hatred* is opposed to love, and produced by the contrary dispositions. And therefore persons hate those who never did them any injury, from the ill opinion they have of their base and vicious inclinations. So that the way to excite this passion is by showing that any one has committed some heinous fact with an ill intent. And the more nearly affected persons are by such actions, in what they account of the greatest concern, the higher in proportion their hatred rises. Since life therefore is esteemed the most valuable good, Cicero endeavours to render Mark Antony odious to the citizens of Rome, by describing his cruelty.

*Emulation* is a disquiet, occasioned by the felicity of another, not because he enjoys it, but because we desire the like for ourselves. So that this passion is in itself good and laudable, as it engages men to pursue those things which are so. For the proper objects of emulation are any advantages of mind, body, or fortune, acquired by study or labour.

Emulation therefore is excited by a lively representation of any desirable advantages which appear to be attainable, from the example of others who are or have been possessed of them. But where the felicity of another occasions an uneasiness, not from the want of it, but because he enjoys it, this passion is called *envy*, which the ancients describe as a hideous monster, feeding upon itself, and being its own tormentor. Aristotle justly observes, that it most usually affects such persons as were once upon a level with those they envy. For most men naturally think so well of themselves, that they are uneasy to see those who were formerly their equals advanced above them. But, as this is a base and vicious passion, the orator is not to be informed how to excite it, but how to lessen or remove it. And the method prescribed by Cicero for this purpose is, to show that the things which occasioned it have not happened to the envied person undeservedly, but are the just reward of his industry or virtue; that he does not so much convert them to his own profit or pleasure, as to the benefit of others; and that the same pains and difficulties are necessary to preserve them with which they were at first acquired.

*Contempt* is opposed to *emulation*, and arises from misconduct in things not of themselves vicious: As where a person either acts below his station and character, or affects to do that for which he is not qualified. Thus Cicero endeavours to expose Cæcilius, and bring him into contempt of the court, for pretending to rival him in the accusation of Verres, for which he was altogether unfit.

2. To *deliberative* discourses may be referred *fear*, *hope*, and *shame*. 22 Of the passions which may be referred to deliberative discourses.

*Fear* arises from the apprehension of some great and impending evil. For the greatest evils, while they appear at a distance, do not much affect us. Such persons occasion fear, who are possessed of power, especially if they have been injured, or apprehend so: likewise those who are addicted to do injuries, or who bear us an ill will. And the examples of others, who have suffered in a like case, or from the same persons, help to excite fear. From the circumstances therefore either of the thing or person, it will not be difficult for the orator to offer such arguments as may be proper to awaken this passion. So Demosthenes, when he would persuade the Athenians to put themselves in a condition of defence against King Philip, enumerates the several acts of hostility already committed by him against the neighbouring states. And because men's private concerns generally more affect them than what relates to the public, it is proper sometimes

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to show the necessary connexion these have with each other, and how the ruin of one draws the other after it.

The contrary passion to *fear* is *hope*; which arises either from a prospect of some future good, or the apprehension of safety from those things which occasion our fear. Young persons are easily induced to hope the best, from the vigour of their spirits. And those who have escaped former dangers are encouraged to hope for the like success for the future. The examples of others also, especially of wise and considerate men, have often the same good effect. To find them calm and sedate when exposed to the like dangers naturally creates confidence and the hopes of safety. But nothing gives persons such firmness and steadiness of mind under the apprehension of any difficulties, as a consciousness of their own integrity and innocence. Let dangers come from what quarter they will, they are best prepared to receive them. They can calmly view an impending tempest, observe the way of its approach, and prepare themselves in the best manner to avoid it. In Cicero's oration for the Manilian law, he encourages the Roman citizens to hope for success against Mithridates, if they chose Pompey for their general, from the many instances of his former successes which he there enumerates.

*Shame* arises from the apprehension of those things that hurt a person's character. *Modesty* has been wisely implanted in mankind by the great Author of nature, as a guardian of virtue, which ought for this reason to be cherished with the greatest care; because, as Seneca has well observed, "if it be once lost, it is scarce ever to be recovered." Therefore the true cause or foundation of shame is any thing base or vicious; for this wounds the character, and will not bear reflection. And he must arrive at no small degree of insensibility, who can stand against such a charge, if he be conscious to himself that it is just. Therefore, to deter persons from vicious actions, or to expose them for the commission of them, the orator endeavours to set them in such a light as may most awaken this passion, and give them the greatest uneasiness by the reflection. And because the bare representation of the thing itself is not always sufficient for this purpose, he sometimes enforces it by enlarging the view, and introducing those persons as witnesses of the fact for whom they are supposed to have the greatest regard. Thus, when some of the Athenians, in an arbitration about certain lands which had been referred to them by the contending parties, proposed it as the shortest way of deciding the controversy, to take the possession of them in their own hands; Cydias, a member of the assembly, to dissuade them from such an unjust action, desired them to imagine themselves at that time in the general assembly of the states of Greece (who would all hear of it shortly), and then consider how it was proper to act. But where persons labour under an excess of modesty which prevents them from exerting themselves in things fit and laudable, it may sometimes be necessary to show that it is faulty and ill grounded. On the other hand, *immodesty*, or impudence, which consists in a contempt of such things as affect the reputation, can never be too much discouraged and exposed. And the way of doing this is to make use of such arguments as are most proper to excite shame. We have a very remarkable instance of it in Cicero's second Philippic, wherein he affixes this character upon Mark Antony through every scene of his life.

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23 Of the passions which may be referred to judicial discourses.

3 To *judicial* discourses, may be referred *anger* and *lenity*, *pity*, and *indignation*.

*Anger* is a resentment, occasioned by some affront, or injury, done without any just reason. Now men are more inclined to resent such a conduct, as they think they less deserve it. Therefore persons of distinction and figure, who expect a regard should be paid to their character, can the less bear any indications of contempt. And those who are eminent in any profession or faculty, are apt to be offended if reflections are cast either upon their reputation or art. Magistrates also, and persons in public stations, sometimes think it incumbent on them to resent indignities for the support of their office. But nothing sooner inflames this passion, than if good services are rewarded with slights and neglect. The instance of Narses, the Roman general, is remarkable in this kind; who, after he had been successful in his wars with the Goths, falling under the displeasure of the emperor Justin, was removed from the government of Italy, and received by the empress with this taunt, *That he must be sent to weave among the girls*; which so provoked him, that he said he would weave such a web, as they would never be able to unravel. And accordingly, he soon after brought down the Longobards, a people of Germany, into Italy; where they settled themselves in that part of the country, which from them is now called *Lombardy*. (See NARSES.) The time and place in which an injury was done, and other circumstances that attended it, may likewise contribute very much to heighten the fact. Hence Demosthenes, in his oration against Midias, endeavours to aggravate the injury of being struck by him, both as he was then a magistrate, and because it was done at a public festival. From hence it appears, that the persons who most usually occasion this passion are such as neglect the rules of decency, contemn and insult others, or oppose their inclinations; as likewise the ungrateful, and those who violate the ties of friendship, or requite favours with injuries. But when the orator endeavours to excite anger, he should be careful not to exceed due bounds in aggravating the charge, lest what he says appear rather to proceed from prejudice, than a strict regard to the demerit of the action.

*Lenity* is the remission of anger. The designs of men's actions are principally to be regarded; and therefore what is done ignorantly, or through inadvertency, is sooner forgiven. Also to acknowledge a fault, submit, and ask pardon, are the ready means to take off resentment. For a generous mind is soon cooled by submission. Besides, he who repents of his fault, does really give the injured party some satisfaction, by punishing himself; as all repentance is attended with grief and uneasiness of mind, and this is apt very much to abate the desire of revenge. As, on the contrary, nothing is more provoking, that when the offender either audaciously justifies the fact, or confidently denies it. Men are likewise wont to lay aside their resentment, when their adversaries happen by some other means to suffer what they think a sufficient satisfaction. Lastly, Easy circumstances, a lucky incident,

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[illegible] any thing which gives the mind a turn to [illegible] and pleasure, has a natural tendency to remove anger. For anger is accompanied with pain and uneasiness, which very ill suit joy and cheerfulness. The orator, therefore, in order to assuage and pacify the minds of his auditors, will endeavour to lessen their opinion of the fault, and by that means to take off the edge of their resentment. And to this purpose, it will be proper either to represent that the thing was not designed, or that the party is sorry for it; or to mention his former services; as also to show the credit and reputation which will be gained by a generous forgiveness. And this last topic is very artfully wrought up by Cicero, in his address to Cæsar, in favour of Ligarius.

*Pity* arises from the calamities of others, by reflecting, that we ourselves are liable to the like misfortunes. So that evils, considered as the common lot of human nature, are principally the cause of pity. And this makes the difference between *pity* and *good will*, which arises merely from a regard to the circumstances of those who want our assistance. But considering the uncertainty of every thing about us, he must seem in a manner divested of humanity, who has no compassion for the calamities of others; since there is no affliction which happens to any man, but either that, or some other as great, may fall upon himself. But those persons are generally soonest touched with this passion, who have met with misfortunes themselves. And by how much greater the distress is, or by how much the person appears less deserving it, the higher pity does it excite; for which reason, persons are generally most moved at the misfortunes of their relations and friends, or those of the best figure and character. The orator, therefore, in order to excite the greater pity, will endeavour to heighten the idea of the calamity, from the several circumstances both of the thing itself and the person who labours under it. A fine example of this may be seen in Cicero's defence of Muræna, *Cap.* 40, &c.

*Indignation*, as opposed to *pity*, is an uneasiness at the felicity of another who does not seem to deserve it. But this respects only external advantages, such as riches, honours, and the like; for virtues cannot be the [illegible] of this passion. Aristotle therefore says, "that pity and indignation are generally to be found in the same persons, and are both evidences of a good disposition." Now the orator excites this passion, by showing the [illegible] to be unworthy of that felicity which he enjoys. And as, in order to move compassion, it is sometimes of use to compare the former happy state of the person with his present calamity; so here, the greater indignation is raised, by comparing his former mean circumstances with his present advancement: as Cicero does in the case of Vatinius.

These are the passions with which an orator is principally concerned. In addressing to which, not only the greatest warmth and force of expression is often necessary; but he must likewise first endeavour to impress his own mind with the same passion he would excite in others.

A man may convince, and even persuade others to act, by mere reason and argument. But that degree of eloquence which gains the admiration of mankind, and properly denominates one an orator, is never found without warmth or passion. Passion, when in such a degree as to rouse and kindle the mind, without throwing it out of the possession of itself, is universally found to exalt all the human powers. It renders the mind infinitely more enlightened, more penetrating, more vigorous and masterly, than it is in its calm moments. A man, actuated by a strong passion, becomes much greater than he is at other times. He is conscious of more strength and force; he utters greater sentiments, conceives higher designs, and executes them with a boldness and a felicity of which on other occasions he could not think himself capable. But chiefly, with respect to persuasion, is the power of passion felt. Almost every man in passion is eloquent. Then he is at no loss for words and arguments. He transmits to others, by a sort of contagious sympathy, the warm sentiments which he feels; his looks and gestures are all persuasive; and nature here shows herself infinitely more powerful than art. This is the foundation of that just and noted rule, *Si vis me flere, dolendum est primum ipsi tibi.*

The warmth, however, which we express, must be suited to the occasion and the subject; for nothing can be more preposterous than an attempt to introduce great vehemence into a subject, which is either of slight importance, or which, by its nature, requires to be treated of calmly. A temperate tone of speech is that for which there is most frequent occasion; and he who is on every subject passionate and vehement, will be considered as a blusterer, and meet with little regard.

## PART II. OF DISPOSITION.

As *Invention* supplies the orator with necessary materials, so *Disposition* directs him how to place them in the most proper and suitable order. Disposition, therefore, considered as a part of oratory, naturally follows invention. And what is here chiefly intended by it is, the placing the several parts of a discourse in a just method and dependence upon one another.

Writers are not all agreed in determining the parts of an oration; though the difference is rather in the manner of considering them, than in the things themselves. But Cicero, whom we shall here follow, mentions six, namely, *Introduction*, *Narration*, *Proposition*, *Confirmation*, *Confutation*, and *Conclusion*.

### Chap. I. *Of the Introduction.*

Introduction gains the hearers and attention of the audience, and gives a general notion of the subject.

The design of this is to prepare the minds of the hearers for a suitable reception of the remaining parts that are to follow. And for this end, three things are requisite; that the orator gain the *good opinion* of his hearers, that he secure their *attention*, and give them some *general notion* of his subject.

1. *Good opinion.* When the orator introduces his discourse

discourse with his own person, he will be careful to do it with modesty, and seem rather to extenuate his virtues and abilities, than to magnify them. And where the nature of the subject may seem to require it, he will endeavour to show, that some just and good reason induced him to engage in it. We have a very fine example of this in Cicero's oration for the poet Aulus Licinius Archias, which begins thus: "If I have any natural genius, which I am sensible is very small, or any ability in speaking, wherein I own I have been very conversant; or any skill acquired from the study and precepts of the best arts, to which my whole life has been devoted; this Aulus Licinius has, in a particular manner, a right to demand of me the fruit of all these things. For as far back as I can remember, and call to mind what passed in my youth to the present time, he has been my chief adviser and encourager both to undertake and pursue this course of studies." When the orator sets out with the persons of those to whom the discourse is made, it is not unusual to commend them for their virtues, and those especially which have a more immediate relation to the present subject. Thus Cicero begins his oration of thanks for the pardon of Marcellus, with an encomium upon the mildness, clemency, and wisdom of Cæsar, to whom it was addressed. But sometimes the orator expresses his gratitude for past favours; as Cicero has done in his orations, both to the people and senate of Rome, after his return from banishment.—And at other times he declares his concern for them and their interest; in which manner Cicero begins his fourth oration against Catiline, which was made in the senate." "I perceive (says he) that all your countenances and eyes are turned on me; I perceive that you are solicitous, not only for your own danger, and that of the state, but for mine likewise, if that should be removed. Your affection for me is pleasant in misfortunes, and grateful in sorrow; but I adjure you to lay it aside, and, forgetting my safety, consider yourselves and your children." But in judicial cases, both the character of the person whose cause he espouses, and that of the adverse party likewise, furnish the orator with arguments for exciting the good will of his hearers: The former, by commemorating his virtues, dignity, or merits, and sometimes his misfortunes and calamities. So Cicero, in his defence of Flaccus, begins his oration in commending him on the account of his services done to the public, the dignity of his family, and his love to his country. And Demosthenes, in his oration against Midias, sets out with a recital of his vices, in order to recommend his own cause to the favourable opinion of the court.

2. *Attention.* On this head, Cicero says, "We shall be heard attentively on one of these three things; if we propose what is great, necessary, or for the interest of those to whom the discourse is addressed." So that, according to him, the topics of attention are much the same with those of good opinion, when taken from the subject. And indeed, people are naturally led to attend either to those things or persons of which they have entertained a favourable opinion. But in order to gain this point, the orator sometimes thinks it proper to request the attention of his audience. Thus Cicero, in his defence of Cluentius, after having shown the heinousness of the charge against him, concludes his introduction in the following manner, speaking to the judges: "Wherefore I entreat, that while I briefly and clearly reply to a charge of many years standing, you will, according to your usual custom, give me a kind and attentive hearing." And again, in his second Philippic, addressing himself to the senate: "But as I must say something for myself, and many things against Mark Antony; one of these I beg of you, that you will hear me kindly, while I speak for myself; and the other I will undertake for, that when I speak against him, you shall hear me with attention." But though the introduction be the most usual and proper place for gaining attention, yet the orator finds it convenient sometimes to quicken and excite his hearers in other parts of his discourse, when he observes they flag, or has something of moment to offer.

3. Some *general account* of the subject of the discourse. This is always necessary; which the two others are not. And therefore it must be left to the prudence of the orator when to use or omit them as he shall judge proper, from the nature of his discourse, the circumstance of his hearers, and how he stands with them. But some account of the subject is what cannot be neglected. For every one expects to be soon informed of the design of the speaker, and what he proposes to treat of. Nor when they are all made use of, it is necessary they should always stand in the order we have here placed them. Cicero sometimes enters immediately upon his subject, and introduces the other heads afterwards. As in his third oration against Catiline, made to the body of the Roman people, which begins thus: "You see that the state, all your lives, estates, fortunes, wives and children, and this seat of the greatest empire, the most flourishing and beautiful city, having by the favour of heaven towards you, and my labours, counsels, and dangers, been this day rescued from fire and sword, the very jaws of destruction, are preserved and restored to you." And then he proceeds to recommend himself to their esteem and benevolence, from the commemoration of these benefits.

> Introduction is not confined to these heads, but can admit of other matter, if furnished by the circumstances of the case.

These are the heads which commonly furnish matter for this part of a discourse. But orators often take occasion from the time, place, largeness of the assembly, or some other proper circumstance, to compliment their hearers, recommend themselves, or introduce the subject upon which they are about to treat. Instances of each of these may be met with in several of Cicero's orations. And sometimes they set out with some comparison, similitude, or other ornament, which they accommodate to the occasion of their discourse. Thus Isocrates enters upon his celebrated panegyric in praise of his countrymen the Athenians with the following comparison: "I have often wondered what could be their design who brought together these assemblies, and instituted the gymnastic sports, to propose so great rewards for bodily strength; and to vouchsafe no honour to those who applied their private labours to serve the public, and so cultivated their minds as to be serviceable to others, to whom they ought to have shown greater regard. For although the strength of a champion was doubled, no benefit would from thence accrue to others; but all enjoy the prudence of one man, who will hearken to his advice." In some cases, orators

Disposition. orators have recourse to a more covert and artful way of opening their subject, endeavour to remove jealousies, apologize for what they are about to say, and seem to refer it to the candour of the hearers to judge of it as they please. Cicero appears to have been a perfect master of this art, and used it with great success. Thus in his seventh Philippic, where he seems to express the greatest concern, lest what he was about to say should give any offence to the senate to whom he was speaking: "I (says he) who always declared for peace, and to whom peace among ourselves, as it is wished for by all good men, was in a particular manner desirable; who have employed all my industry in the forum, in the senate, and in the defence of my friends, whence I have arrived to the highest honours, a moderate fortune, and what reputation I enjoy; I therefore, who owe what I am to peace, and without it could not have been the person I am, be that what it will, for I would arrogate nothing to myself; I speak with concern and fear, how you will receive what I am going to say; but I beg and entreat you, from the great regard I have always expressed for the support and advancement of your honour, that if any thing said by me should at first appear harsh or unfit to be received, you will notwithstanding please to hear it without offence, and not reject it till I have explained myself: I then, for I must repeat it again, who have always approved of peace, and promoted it, am against a peace with Mark Antony." This is called *insinuation*; and may be necessary, where a cause is in itself doubtful, or may be thought so from the received notions of the hearers, or the impressions already made upon them by the contrary side. An honest man would not knowingly engage in a bad cause; and yet, through prevailing prejudice, that may be so esteemed which is not so in itself. In these cases, therefore, great caution and prudence are necessary to give such a turn to things, and place them in that view as may be least liable to offence. And because it sometimes happens that the hearers are not so much displeased at the subject as the person, Quintilian's rule seems very proper, when he says, "If the subject displeases, the character of the person should support it; and when the person gives offence, he should be helped by the cause."

## CHAP. II. *Of Narration.*

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Narration brings forward all those circumstances of a case, &c. in their proper and natural order, which are calculated to set it in a just or a strong light.

THE orator having prepared his hearers to receive his discourses with candour and attention, and acquainted them with his general design in the introduction, before he proceeds directly to his subject, often finds it necessary to give some account of what preceded, accompanied, or followed upon it. And this he does in order to enlarge the view of the particular point in dispute, and place it in a clearer light. This is called *narration*; which is a recital of something done, in the order and manner in which it was done. Hence it is easy to perceive what those things are which properly enter into a narration. And such are the cause, manner, time, place, and consequences of an action; with the temper, fortune, views, ability, associates, and other circumstances of those concerned in it. Not that each of these particulars is necessary in every narration: but so many of them at least as are requisite to set the matter in a just light, and make it appear credible. Besides, in relating a fact, the orator does not content himself with such an account of it as is barely sufficient to render what he says intelligible to his hearers; but describes it in so strong and lively a manner, as may give the greatest evidence to his relation, and make the deepest impression upon their minds. And if any part of it appears at present less probable, he promises to clear up and remove any remaining doubts in the progress of his discourse. For the foundation of his reasoning afterwards is laid in the narration, from whence he takes his arguments for the confirmation. And therefore it is a matter of no small importance that this part be well managed, since the success of the whole discourse so much depends upon it. See NARRATION.

There are four properties required in a good narration; that it be short, clear, probable, and pleasant.

1. The *brevity* of a narration is not to be judged of barely from its length: for that may be too long, which contains but a little; and that too short, which comprehends a great deal. Wherefore this depends upon the nature of the subject, since some things require more words to give a just representation of them, and others fewer. That may properly therefore be called a *short narration*, which contains nothing that could well have been omitted, nor omits any thing which was necessary to be said. Now, in order to avoid both these extremes, care should be taken not to go farther back in the account of things, nor to trace them down lower, than the subject requires; to say that only in the general, which does not need a more particular explication; not to assign the causes of things, when it is enough to show they were done; and to omit such things as are sufficiently understood, from what either preceded, or was consequent upon them. But the orator should be careful, lest, while he endeavours to avoid prolixity, he run into obscurity. Horace was very sensible of this danger, when he said,

By striving to be short, I grow obscure.

2. *Perspicuity*. This may justly be esteemed the chief excellency of language. For as the design of speech is to communicate our thoughts to others, that must be its greatest excellence which contributes most to this end; and that, doubtless, is perspicuity. As perspicuity therefore is requisite in all discourse, so it is particularly serviceable in a narration, which contains the substance of all that is to be said afterwards. Wherefore, if this be not sufficiently understood, much less can those things which receive their light from it. Now the following things render a narration clear and plain: Proper and significant words, whose meaning is well known and determined; short sentences, though full and explicit, whose parts are not perplexed, but placed in their just order; proper particles to join the sentences, and show their connexion and dependence on each other; a due regard to the order of time, and other circumstances necessary to be expressed; and, lastly, suitable transitions.

3. *Probability*. Things appear probable when the causes assigned for them appear natural; the manner in which they are described is easy to be conceived; the consequences are such as might be expected; the characters of the persons are justly represented;

 and

Disposition. and the whole account is well attested, consistent with itself, and agreeable to the general opinion. Simplicity likewise in the manner of relating a fact, as well as in the style, without any reserve or appearance of art, contributes very much to its credibility. For truth loves to appear naked and open, stript of all colouring or disguise. The conspiracy of Catiline was so daring and extravagant, that no one but such a desperado could ever have undertaken it with any hopes of success. However, Cicero's account of it to the senate was so full and exact, and so well suited to the character of the person, that it presently gained credit. And therefore, when, upon the conclusion of Cicero's speech, Catiline, who was present, immediately stood up, and desired they would not entertain such hard thoughts of him, but consider how much his family had always been attached to the public interest, and the great services they had done the state; their resentment rose so high, that he could not be heard: upon which he immediately left the city, and went to his associates.

4. The last thing required in a narration is, that it be *pleasant* and *entertaining*. And this is more difficult, because it does not admit of that accurate composition and pompous dress which delight the ear, and recommend some other parts of a discourse. For it certainly requires no small skill in the speaker, while he endeavours to express every thing in the most natural, plain, and easy manner, not to grow flat and tiresome. For Quintilian's remark is very just, that "the most experienced orators find nothing in eloquence more difficult, than what all who hear it fancy they could have said themselves." And the reason of this seems very obvious. For as all art is an imitation of nature, the nearer it resembles that, the more perfect it is in its kind. Hence unexperienced persons often imagine that to be easiest which suits best with those natural ideas to which they have been accustomed; till, upon trial, they are convinced of their mistake. Wherefore, to render this part of a discourse pleasant and agreeable, recourse must be had to variety both in the choice of words and turns of the expression. And therefore questions, admirations, interlocutions, imagery, and other familiar figures, help very much to diversify and enliven a narration, and prevent it from becoming dull and tedious, especially when it is carried on to any considerable length.

27 The uses of narration. Having given a brief account of the nature and properties of a narration, we shall now proceed to consider the uses of it.

Laudatory orations are usually as it were a sort of continued narration, set off and adorned with florid language and fine images proper to grace the subject, which is naturally so well fitted to afford pleasure and entertainment. Wherefore a separate narration is more suited to *deliberative* and *judicial* discourses. In Cicero's oration for the Manilian law (which is of the former kind), the design of the narration is to show the Roman people the necessity of giving Pompey the command of the army against King Mithridates, by representing the nature of that war, which is done in the following manner: "A great and dangerous war (says he) threatens your revenues and allies from two very powerful kings, Mithridates and Tigranes; one of whom not being pursued after his defeat, and the other provoked, they think they have an opportunity to seize Asia. Letters are daily brought from those parts to worthy gentlemen of the equestrian order, who have large concerns there in farming your revenues: they acquaint me, as friends, with the state of the public affairs, and danger of their own; that many villages in Bithynia, which is now your province, are burnt down; that the kingdom of Ariobarzanes, which borders upon your revenues, is entirely in the enemy's power; that Lucullus, after several great victories, is withdrawn from the war; that he who succeeds him is not able to manage it; that all the allies and Roman citizens wish and desire the command of that war may be given to one particular person; and that he alone, and no other, is dreaded by the enemies. You see the state of the case; now consider what ought to be done." Here is an unhappy scene of affairs, which seemed to call for immediate redress. The causes and and reasons of it are assigned in a very probable manner, and the account well attested by persons of character and figure. And what the consequences would be, if not timely prevented, no one could well be ignorant. The only probable remedy suggested in general is, the committing that affair to one certain person, which he afterwards shows at large could be no other than Pompey. But in Cicero's defence of Milo (which is of the *judicial* kind), the design of the narration, which is greatly commended by Quintilian, is to prove that, in the combat between Clodius and Milo, the former was the aggressor. And in order to make this appear, he gives a summary account of the conduct of Clodius the preceding year; and from the course of his actions and behaviour, shows the inveterate hatred he bore to Milo, who obstructed him in his wicked designs. For which cause he had often threatened to kill him, and given out that he should not live beyond such a time: and accordingly he went from Rome without any other apparent reason, but that he might have an opportunity to attack him in a convenient place near his own house, by which he knew Milo was then obliged to pass. Milo was in the senate that day, where he staid till they broke up, then went home, and afterwards set forward on his journey. When he came to the place in which he was to be assaulted, Clodius appeared every way prepared for such a design, being on horseback, and attended with a company of desperate ruffians ready to execute his commands; whereas Milo was with his wife in a chariot, wrapped up in his cloak, and attended with servants of both sexes. These were all circumstances which preceded the fact. And as to the action itself, with the event of it, the attack, as Cicero says, was begun by the attendants of Clodius from a higher ground, who killed Milo's coachman; upon which Milo, throwing off his cloak, leaped out, and made a brave defence against Clodius's men, who were got about the chariot. But Clodius, in the heat of the skirmish, giving out that Milo was killed, was himself slain by the servants of Milo, to avenge, as they thought, the death of their master. Here seems to be all the requisites proper to make this account credible. Clodius's open and avowed hatred of Milo, which proceeded so far as to threaten his life; the time of his leaving Rome; the convenience of the place; his habit and company so different from those of

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of Milo; joined with his known character of a most profligate and audacious wretch, could not but render it very probable that he had formed that design to kill Milo. And which of them began the attack might very reasonably be credited from the advanced ground on which Clodius and his men were placed; the death of Milo's coachman at the beginning of the combat; the skirmish afterwards at the chariot; and the reason of Clodius's own death at last, which does not appear to have been intended, till he had given out that Milo was killed.

But a distinct and separate narration is not always necessary in any kind of discourse. For if the matter be well known before, a set and formal narrative will be tedious to the hearers. Or if one party has done it already, it is needless for the other to repeat it. But there are three occasions especially, in which it may seem very requisite: when it will bring light to the subject; when different accounts have already been given out concerning it; or when it has been misrepresented by the adverse party. If the point in controversy be of a dubious nature, or not sufficiently known to the hearers, a distinct account of the matter, with the particular circumstances attending it, must be very serviceable, in order to let them into a true state of the case, and enable them to judge of it with greater certainty.

Moreover, where the opposite party has set the matter in a false light by some artful and invidious turn, or loaded it with any odious circumstances, it seems no less necessary that endeavours should be used to remove any ill impressions, which otherwise might remain upon the minds of the hearers, by a different and more favourable representation. And if any thing can be fixed upon to make the contrary account appear absurd or incredible, it ought particularly to be remarked. Thus Cicero, in his defence of Sextus Roscius, shows that he was many miles distant from Rome at the time he was charged with having killed his father there. "Now (says he), while Sextus Roscius was at Ameria, and this Titus Roscius [*his accuser*] at Rome, Sextus Roscius [*the father*] was killed at the baths on Mount Palatine, returning from supper. From whence I hope there can be no doubt who ought to be suspected of the murder. And, were not the thing plain of itself, there is this farther suspicion to fix it upon the prosecutor; that, after the fact was committed, one Mallius Glaucia, an obscure fellow, the freedman, client, and familiar, of this Titus Roscius, first carried the account of it to Ameria, not to the son of the deceased, but to the house of Titus Capito his enemy;" with more to the same purpose. But what we bring it for is, to show the use which Cicero makes of this narration for retorting the crime upon the prosecutors.

But the orator should be very careful, in conducting this part, to avoid every thing which may prejudice the cause he espouses. Falsehood, and a misrepresentation of facts, are not to be justified; but no one is obliged to say those things which may hurt himself. We shall just mention one instance of this from Cicero, where he has shown great skill in this respect, in pleading before Cæsar for the pardon of Ligarius, who had joined with Pompey in the civil war. For Ligarius, having been represented by the adverse party as an enemy to Cæsar, and so esteemed by Cæsar himself; Cicero very artfully endeavours in his narration to take off the force of this charge, by showing, that, when the war first broke out, he refused to engage in it; which he would not have done, had he borne any personal hatred to Cæsar. "Quintus Ligarius (says he), before there was any suspicion of a war, went into Africa as a legate to the proconsul Caius Considius; in which he so approved himself, both to the Roman citizens and allies, that, when Considius left the province, the inhabitants would not be satisfied he should leave the government in the hands of any other person. Therefore Quintus Ligarius having excused himself in vain for some time, accepted of the government against his will; which he so managed during the peace, that both the citizens and allies were greatly pleased with his integrity and justice. The war broke out on a sudden, which those in Africa did not hear of till it was begun: but upon the news of it, partly through inconsiderate haste, and partly from blind fear, they looked out for a leader, first for their own safety, and then as they were affected; when Ligarius, thinking of home, and desirous to return to his friends, would not be prevailed on to engage in any affairs. In the mean time, Publius Accius Varus, the prætor, who was formerly governor of Africa, coming to Utica, recourse was immediately had to him, who very eagerly took upon himself the government; if that can be called a *government*, which was conferred on a private man by the clamour of the ignorant multitude, without any public authority. Ligarius, therefore, who endeavoured to avoid every thing of that kind, ceased to act soon after the arrival of Varus." Here Cicero ends his narrative. For though Ligarius afterwards joined with Pompey's party, yet to have mentioned that, which was nothing more than what many others had done, whom Cæsar had already pardoned; could have served only to increase his displeasure against him. And therefore he doubtless showed great skill in so managing his account, as to take off the main force of the accusation, and by that means make way for his pardon, which he accordingly obtained.

## Chap. III. *Of the Proposition.*

23 The proposition is a distinct and express manner of laying down the subject on which an orator means to treat.

In every just and regular discourse, the speaker's intention is to prove or illustrate something. And when he lays down the subject upon which he designs to treat, in a distinct and express manner, this is called the *proposition*.

Orators use several ways in laying down the subject of their discourses. Sometimes they do it in one general proposition. We have an instance of this in Cicero's speech to the senate, the day after Cæsar was killed (as it is given us by Dion Cassius), in which his design was to persuade them to peace and unanimity. "This (says he) being the state of our affairs, I think it necessary that we lay aside all the discord and enmity which have been among us, and return again to our former peace and agreement." And then he proceeds to offer his reasons for this advice.

At other times, to give a clearer and more distinct view of their discourse, they subjoin to the proposition the

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the general heads of argument by which they endeavour to support it. This method Cicero uses in his seventh Philippic, where he says, "I who have always commended and advised to peace, am against a peace with Mark Antony. But why am I averse to peace? Because it is base, because it is dangerous, and because it is impracticable. And I beseech you to hear me with your usual candour, while I make out these three things."

29
When the subject refers to several different things, and requires to be laid down in distinct propositions, it is called a *partition*.

But when the subject relates to several different things, which require each of them to be separately laid down in distinct propositions, it is called a *partition*; though some have made two kinds of *partition*, one of which they call *separation*, and the other *enumeration*. By the former of these, the orator shows in what he agrees with his adversary, and wherein he differs from him. So, in the case formerly mentioned, of a person accused of sacrilege for stealing private money out of a temple, he who pleads for the defendant says, "He owns the fact; but it being private money, the point in question is, Whether this be sacrilege?" And in the cause of Milo, Cicero speaking of Clodius, says, "The point which now comes before the court, is not, Whether he was killed or not; that we confess: but, Whether justly or unjustly." Now in reality here is no partition, since the former branch of the proposition is what is agreed upon, and given up; and consequently it is only the latter that remains to be disputed. It is called *enumeration*, when the orator acquaints his hearers with the several parts of his discourse upon which he designs to treat. And this alone, properly speaking, is a *partition*. Thus Cicero states his plea in his defence of Muræna: "I perceive the accusation consists of three parts: the first respects the conduct of his life; the second his dignity; and the third contains a charge of bribery."

There are three things requisite in a good partition; that it be *short, complete*, and consist but of a *few members*.

A partition is said to be *short*, when each proposition contains in it nothing more than what is necessary. So that the brevity here required is different from that of a narration; for that consists chiefly in things, this in words. And, as Quintilian justly observes, brevity seems very proper here, where the orator does not show what he is then speaking of, but what he designs to discourse upon.

Again, It ought to be *complete* and perfect. And for this end, care must be taken to omit no necessary part in the enumeration.

But, however, there should be as *few heads* as is consistent with the nature of the subject. The ancient rhetoricians prescribe three or four at the most. And we do not remember that Cicero ever exceeds that number. But it is certain, the fewer they are, the better, provided nothing necessary be omitted. For too large a number is both difficult of retention, and apt to introduce that confusion which partition is designed to prevent.

Hitherto we have been speaking only of those heads into which the subject or general argument of the discourse is at first divided. For it is sometimes convenient to divide these again, or at least some of them, into several parts or members. And when this happens, it is best done, as the speaker comes to each of them in the order at first laid down; by which means the memory of the hearers will be less burdened than by a multitude of particulars at one and the same time. Thus Cicero, in his oration for the Manilian law, comprises what he designs to say under three general heads. "First (says he) I shall speak of the nature of the war, then of its greatness, and lastly about the choice of a general." And when he comes to the first of these, he divides it again into four branches; and shows, "how much the glory of the Romans, the safety of their allies, their greatest revenues, and the fortunes of many of their citizens, were all concerned in that war." The second head, in which he considers the greatness of the war, has no division. But when he comes to the third head, concerning the choice of a general, he divides that likewise into four parts; and shows, that so many virtues are necessary in a consummate general, such a one as was proper to have the management of that war, namely, *skill in military affairs, courage, authority*, and *success*: all which he attributes to Pompey. And this is the scheme of that celebrated oration.

This subdividing, however, should never have place but when it is absolutely necessary. To split a subject into a great many minute parts, by divisions and subdivisions without end, has always a bad effect in speaking. It may be proper in a logical treatise; but it makes an oration appear hard and dry, and unnecessarily fatigues the memory. In a sermon, there may be three to five, or six heads, including subdivisions; seldom should there be more.

30
Negative and positive divisions of a subject.

Further, Some divide their subject into two parts, and propose to treat upon it *negatively* and *positively*; by showing first what it is not, and then what it is. But while they are employed to prove what it is not, they are not properly treating upon that, but something else; which seems as irregular as it is unnecessary. For he who proves what a thing is, does at the same time show what it is not. However, in fact, there is a sort of division by affirmation and negation, which may sometimes be conveniently used. As if a person, charged with killing another, should thus state his defence: *I had done right if I had killed him, but I did not kill him*. Here indeed, if the latter can be plainly made to appear, it may seem needless to insist upon the former. But if that cannot be so fully proved, but there may be room left for suspicion, it may be proper to make use of both: for all persons do not see things in the same light, and he who believes the fact, may likewise think it just; while he who thinks it unjust, may not believe it, but rather suppose, had it really been committed by the party, he would not have denied it, since he looked upon it as defensible. And this method of proceeding, Quintilian compares to a custom often used in traffic, when persons make a large demand at first, in order to gain a reasonable price. Cicero uses this way of reasoning in his defence of Milo; but in the contrary order; that is, he first answers the charge; and then justifies the fact, upon the supposition that the charge was true. For he proves, first, that Clodius was the aggressor; and not Milo, as the contrary party had asserted: and then, to give the greater advantage to his cause, he proceeds to show, that if Milo had been the aggressor, it would however have been a glorious action

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A good and just partition is attended with considerable advantages. For it gives both light and ornament to a discourse. And it is also a great relief to the hearers, who, by means of these stops and rests, are much better enabled to keep pace with the speaker without confusion, and by casting their thoughts either way, from what has been said, both know and are prepared for what is to follow. And as persons, in travelling a road with which they are acquainted, go on with greater pleasure and less fatigue, because they know how far it is to their journey's end; so to be apprised of the speaker's design, and the several parts of his discourse which he proposes to treat on, contributes very much to relieve the hearer, and keep up his attention. This must appear very evident to all who consider how difficult it is to attend long and closely to one thing, especially when we do not know how long it may be before we are like to be released. Whereas, when we are beforehand acquainted with the scheme, and the speaker proceeds regularly from one thing to another, opportunity is given to ease the mind, by relaxing the attention, and recalling it again when necessary. In a sermon, or in a pleading at the bar, few things are of greater consequence than a proper or happy division. It should be studied with much accuracy and care; for if one take a wrong method at first setting out, it will lead him astray in all that follows. It will render the whole discourse either perplexed or languid; and though the hearers may not be able to tell where the fault or disorder lies, they will be sensible there is a disorder somewhere, and find themselves little affected by what is spoken. The French writers of sermons study neatness and elegance in the division of their subjects much more than the English do; whose distributions, though sensible and just, yet are often inartificial and verbose.

## Chap. IV. *Of Confirmation.*

31 Confirmation is used for the arguments brought in defence of a subject.

The orator having acquainted his hearers, in the proposition, with the subject on which he designs to discourse, usually proceeds either to prove or illustrate what he has there laid down. For some discourses require nothing more than an enlargement or illustration, to set them in a proper light, and recommend them to the hearers; for which reason, likewise, they have often no distinct proposition. But where arguments are brought in defence of the subject, this is properly *confirmation*. For, as Cicero defines it, "confirmation is that which gives proof, authority, and support to a cause, by reasoning." And for this end, if any thing in the proposition seems obscure, or liable to be misunderstood, the orator first takes care to explain it, and then goes on to offer such arguments for the proof of it, and represent them in such a light, as may be most proper to gain the assent of his hearers.

But here it is proper to observe, that there are different ways of reasoning suited to different arts. The mathematician treats his subject after another manner than the logician, and the orator in a method different from them both. Two methods of reasoning are employed by orators, the *synthetic* and *analytic*.

32 Synthetic reasoning may always be resolved into a syllogism or series of syllogisms.

1. Every piece of synthetic reasoning may be resolved into a syllogism or series of syllogisms, (see Logic.) Thus we may reduce Cicero's argument, by which he endeavours to prove that Clodius assaulted Milo, and not Milo Clodius, to a syllogism in this manner:

*He was the aggressor, whose advantage it was to kill the other.*

*But it was the advantage of Clodius to kill Milo, and not Milo to kill him.*

*Therefore Clodius was the aggressor, or he assaulted Milo.*

The thing to be proved was, that Clodius assaulted Milo, which therefore comes in the conclusion: and the argument, by which it is proved, is taken from the head of profit or advantage. Thus the logician would treat this argument; and if either of the premises were questioned, he would support it with another syllogism. But this short and dry way of reasoning does not at all suit the orator: who not only for variety changes the order of the parts, beginning sometimes with the minor, and at other times with the conclusion, and ending with the major; but likewise clothes each part with such ornaments of expression as are proper to enliven the subject, and render it more agreeable and entertaining. And he frequently subjoins, either to the major proposition, or minor, and sometimes to both, one or more arguments to support them; and perhaps others to confirm or illustrate them as he thinks it requisite. Therefore, as a logical syllogism consists of three parts or propositions, a rhetorical syllogism frequently contains four, and many times five parts. And Cicero reckons this last the most complete. But all that is said in confirmation of either of the premises is accounted but as one part. This will appear more evident by examples: By a short syllogism Cicero thus proves, that the Carthaginians were not to be trusted: "Those who have often deceived us, by violating their engagements, ought not to be trusted. For if we receive any damage by their treachery, we can blame nobody but ourselves. But the Carthaginians have often so deceived us. Therefore it is madness to trust them." Here the major proposition is supported by a reason. The minor needed none; because the treachery of the Carthaginians was well known. So that this syllogism consists of four parts. But by a syllogism of five parts he proves somewhat more largely and elegantly, that the world is under the direction of a wise governor. The major is this: "Those things are better governed which are under the direction of wisdom, than those which are not." This he proves by several instances: "A house managed with prudence has every thing in better order, and more convenient, than that which is under no regulation. An army commanded by a wise and skilful general is in all respects better governed than one which has a fool or a madman at the head of it. And the like is to be said of a ship, which performs her course best under the direction of a skillful pilot." Then he proceeds to the minor thus: "But nothing is better governed than the universe."

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Which he proves in this manner: "The rising and setting of the heavenly bodies keep a certain determined order; and the several seasons of the year do not only necessarily return in the same manner, but are suited to the advantage of the whole; nor did the vicissitudes of night and day ever yet become prejudicial, by altering their course." From all which he concludes, "That the world must be under the direction of a wise governor." In both these examples, the regular order of the parts is observed. We shall therefore produce another, in which the order is directly contrary; for beginning with the conclusion, he proceeds next to the minor proposition, and so ends with the major. In his defence of Cœlius, his design is to prove that Cœlius had not led a loose and vicious life, with which his enemies had charged him. And this he does, by showing he had closely followed his studies, and was a good orator. This may probably at first sight appear but a weak argument; though to him who considers what Cicero everywhere declares necessary to gain that character, it may perhaps be thought otherwise. The sense of what he says here may be reduced to this syllogism.

*Those who have pursued the study of oratory, so as to excel in it, cannot have led a loose and vicious life.*
*But Cœlius has done this.*
*Therefore his enemies charge him wrongfully.*

But let us hear Cicero himself. He begins with the conclusion, thus: "Cœlius is not chargeable with profuseness, extravagancy, contracting of debts, or intemperance, a vice which age is so far from abating, that it rather increases it. Nay, he never engaged in amours, and those pleasures of youth, as they are called, which are soon thrown off, as reason prevails." Then he proceeds to the minor, and shows from the effects, that Cœlius had closely applied himself to the best arts, by which he means those necessary for an orator: "You have now heard him make his own defence, and you formerly heard him engaged in a prosecution (I speak this to vindicate, not to applaud him), you could not but perceive his manner of speaking, his ability, his good sense, and command of language. Nor did he only discover a good genius, which will oftentimes do much of itself when it is not improved by industry; but what he said (if my affection for him did not bias my judgment) appeared to be the effect of learning, application, and study." And then he comes to the major: "But be assured, that those vices charged upon Cœlius, and the studies upon which I am now discoursing, cannot meet in the same person. For it is not possible that a mind, disturbed by such irregular passions, should be able to go through what we orators do, I do not mean only in speaking, but even in thinking." And this he proves by an argument taken from the scarcity of good orators. "Can any other reason be assigned, why so few, both now, and at all times, have engaged in this province, when the rewards of eloquence are so magnificent, and it is attended with so great delight, applause, glory, and honour? All pleasures must be neglected; diversions, recreations, and entertainments omitted; and even the conversation of all our friends must in a manner be laid aside. This it is which deters persons from the labour and study of oratory; not their want of genius or education."

2. By *Enthymem.* But orators do not often use complete syllogisms, but most commonly enthymems. An *enthymem*, as is shown elsewhere, is an imperfect syllogism, consisting of two parts; the conclusion, and one of the premises. And in this kind of syllogism, that proposition is omitted, whether it be the major or minor, which is sufficiently manifest of itself, and may easily be supplied by the hearers. But the proposition that is expressed is usually called the *antecedent*, and the conclusion the *consequent*. So if the major of that syllogism be omitted, by which Cicero endeavours to prove that Clodius assaulted Milo, it will make this enthymem:

33
Orators do not often use complete syllogisms, but most commonly imperfect ones, called enthymems.

*The death of Milo would have been an advantage to Clodius.*
*Therefore Clodius was the aggressor; or, therefore, he assaulted Milo.*

In like manner that other syllogism above-mentioned, by which he shows that the Carthaginians ought not to be trusted, by omitting the minor, may be reduced to the following enthymem:

*Those who have often broke their faith ought not to be trusted.*
*For which reason the Carthaginians ought not to be trusted.*

Every one would readily supply the minor, since the perfidiousness of the Carthaginians was known to a proverb. But it is reckoned a beauty in enthymems, when they consist of contrary parts: because the turn of them is most acute and pungent. Such is that of Micipsa in Sallust: "What stranger will be faithful to you who are an enemy to your friends?" And so likewise that of Cicero for Milo, speaking of Clodius: "You sit as avengers of his death; whose life you would not restore, did you think it in your power." Orators manage enthymems in the same manner they do syllogisms; that is, they invert the order of the parts, and confirm the proposition by one or more reasons: and therefore a rhetorical enthymem frequently consists of three parts, as a syllogism does of five. Though, strictly speaking, a syllogism can consist of no more than three parts, and an enthymem but of two: and the arguments brought to support either of the propositions constitute so many new enthymems, of which the part they are designed to prove is the conclusion. To illustrate this by an example:

*An honest man thinks himself under the highest obligation to his country.*
*Therefore he should shun no danger to serve it.*

In this *enthymem* the major is wanting, which would run thus: "He who is under the highest obligations to another, should shun no danger in order to serve him." This last proposition is founded upon the common principle of gratitude; which requires that, to the utmost of our power, a return should be made in proportion to the kindness received. And this being a maxim generally allowed, it is omitted by the orator. But now this enthymem, consisting of the minor and conclusion, might be managed in some such manner

Disposition. as this, beginning with the conclusion: "An honest man ought to shun no danger, but readily expose his life for the safety and preservation of his country." Then the reason of this conduct might be added, which is the antecedent of the enthymem, or minor of the syllogism: "For he is sensible that his obligations to his country are so many, and so great, that he can never fully requite them." And this again might be confirmed by an enumeration of particulars; "He looks upon himself as indebted to his country for every thing he enjoys; for his friends, relations, all the pleasures of life, and even for life itself. Now the orator calls this *one enthymem*, though in reality there are two: For the second reason, or argument, added to the first, becomes the antecedent of a new enthymem, of which the first reason is the consequent. And if these two enthymems were expressed separately in the natural order of the parts, the former would stand thus: "An honest man thinks himself under the highest obligations to his country; therefore he ought to shun no danger for its preservation." The latter thus: "An honest man esteems himself indebted to his country for every thing he enjoys; therefore he thinks he is under the highest obligations to it." The same thing might be proved in the like way of reasoning, by arguments of a different kind. From comparison, thus: "As it would be thought base and ungrateful in a son not to hazard himself for the preservation of his father; an honest man must certainly esteem it so when his country is in danger." Or from an example, in this manner: "An honest man in like circumstances would propose to himself the example of Decius, who freely gave up his life for the service of his country. He gave up his life indeed, but did not lose it; for he cannot be said to have lost his life, who lives in immortal honour." Orators frequently intermix such arguments to adorn and illustrate their subject with others taken from the nature and circumstances of things. And now, if we consider a little this method of reasoning, we shall find it the most plain and easy imaginable. For when any proposition is laid down, and one or more reasons subjoined to prove it, each reason joined with the proposition, makes a distinct enthymem, of which the proposition is the conclusion. Thus Cicero, in his seventh Philippic, lays down this as the foundation of his discourse, "That he is against a peace with Mark Antony; for which he gives three reasons: "Because it is base, because it is dangerous, and because it is impracticable." These severally joined with the proposition, form three enthymems; and upon each of these he discourses separately, which make up that oration. And this method is what persons for the most part naturally fall into, who know nothing of the terms *syllogism* or *enthymem*. They advance something, and think of a reason to prove it, and another perhaps to support that; and, so far as their invention will assist them, or they are masters of language, they endeavour to set what they say in the plainest light, give it the best dress, embellish it with proper figures and different turns of expression; and, as they think convenient, illustrate it with similitudes, comparisons, and the like ornaments, to render it most agreeable, till they think what they have advanced sufficiently proved. As this method of arguing therefore is the most plain, easy, and natural; so it is what is most commonly used in oratory. Whereas a strict syllogistical way of discoursing is dry and jejune, cramps the mind, and does not admit of those embellishments of language which are a great advantage to the orator: for which reason he seldom uses complete syllogisms; and when he does, it is with great latitude. In every discourse care should be taken not to blend arguments confusedly together that are of a separate nature. "All arguments (says the elegant Dr Blair) are directed to prove one or other of these three things; that something is true; that it is morally right or fit; or that it is profitable and good. These make the three great subjects of discussion among mankind; truth, duty, and interest But the arguments directed towards any one of them are generally distinct; and he who blends them all under one topic, which he calls his argument, as, in sermons especially, is too often done, will render his reasoning indistinct and inelegant. Suppose, for instance, that I am recommending to an audience benevolence, or the love of our neighbour; and that I take my first argument from the inward satisfaction which a benevolent temper affords; my second, from the obligation which the example of Christ lays upon us to this duty; and third. from its tendency to procure us the good will of all around us; my arguments are good, but I have arranged them wrong: for my first and third arguments are taken from considerations of interest, internal peace, and external advantages; and between these, I have introduced one, which rests wholly upon duty. I should have kept those classes of arguments, which are addressed to different principles in human nature, separate and distinct."

34 The analytic method of reasoning nearly the same with the Socratic.

II. The other method of reasoning is the analytic, in which the orator conceals his intention concerning the point he is to prove, till he has gradually brought his hearers to the designed conclusion. They are led on, step by step, from one known truth to another, till the conclusion be stolen from them, as the natural consequence of a chain of propositions. As, for instance, when one intending to prove the being of a God, sets out with observing that every thing which we see in the world has had a beginning; that whatever has had a beginning, must have had a prior cause; that in human productions, art shown in the effect, necessarily infers design in the cause; and proceeds leading you on from one cause to another, till you arrive at one supreme first cause, from whom is derived all the order and design visible in his works. This is much the same with the Socratic method, by which that philosopher silenced the sophists of his age.

He proceeded by several questions, which being separately granted, the thing designed to be inferred was afterwards put, which, by reason of its similitude with several cases allowed before, could not be denied. But this is a captious way of reasoning; for while the respondent is not aware of what is designed to be inferred, he is easily induced to make those concessions, which otherwise he would not. Besides, it is not so well suited to continued discourses, as to those which are interlocutory; and therefore we meet with it oftenest in the Socratic dialogues both of Plato and Xenophon. However, it may be made use of in oratory by a figure called *subjection*, when the same person

Disposition. son first puts the question, and then makes the answer. So in the famous cause of Epaminondas, general of the Thebans, who was accused for refusing to surrender his command to his successor appointed by the state, till after he had engaged the enemy, and given them a total defeat, Cicero thus represents his accuser pleading for the words of the law against Epaminondas, who alleged the intention of it in his defence: "Should Epaminondas add that exception to the law, which, he says, was the intention of the writer, namely, *Except any one refuse to give up his command when it is for the interest of the public he should not;* would you admit of it? I believe not. Should you yourselves, which is a thing most remote from your justice and wisdom, in order to screen him, order this exception to be added to the law, without the command of the people; would the Thebans suffer it to be done? No certainly. Can it be right then to come into that, as if it was written, which it would be a crime to write? I know it cannot be agreeable to your wisdom to think so."

35 May comprehend reasoning by *example*.

Under the analytic method may be comprehended reasoning by *example*. Rhetoricians use this word in a different sense from the common acceptation. For that is usually called an *example*, which is brought either to prove or illustrate some general assertion: As if any one should say, that *human bodies may be brought to sustain the greatest labours by use and exercise;* and in order to prove this should relate what is said of Milo of Croton, that "by the constant practice of carrying a calf several furlongs every day, he could carry it as far after it had grown to its full size." But in oratory the word *example* is used for any kind of similitude; or, as Vossius defines it, "When one thing is inferred from another, by reason of the likeness which appears between them." Hence it is called an *imperfect induction*, which infers something from several others of a like nature, and has always the greatest force when the examples are taken from facts. Now facts may be compared with respect to some agreement or similitude between them, which in themselves are either equal or unequal. Of the former kind this is an instance: "Cato acted as became a patriot and a lover of his country's liberty, in opposing the arms of Cæsar: and therefore so did Cicero." The reason of the inference is founded in the parity of the case, which equally concerned all good subjects of the Roman government at that time. For all were alike obliged to oppose a common enemy, who endeavoured to subvert the constitution, and subject them to his own arbitrary power. But though an example consists in the comparison of two single facts, yet several persons may be concerned in each fact. Of this kind is that which follows: "As Pompey, Cæsar, and Crassus, acted illegally in the first triumvirate, by engrossing the sole power into their own hands, and by that means violating the public liberty; so likewise did Augustus, Mark Antony, and Lepidus, in the second triumvirate, by pursuing the same measures." But when Cicero defends Milo for killing Clodius, from the like instances of Ahala Servilius, Scipio Nasica, Lucius Opimius, and others; that is not an example, but an induction: because one thing is there inferred from its similitude to several others. But when a comparison is made between two facts that are unequal, the inference may be either from the greater to the less, or from the less to the greater. From the greater to the less in this manner: "Cæsar had no just pretensions to the Roman government, and therefore much less had Antony." The reason lies in the difference between the two persons. Cæsar had very much enlarged the bounds of the Roman empire by his conquests, and greatly obliged the populace by his generosity; but as he had always acted by an authority from the senate and people of Rome, these things gave him no claim to a power over them. Much less then had Antony any such pretence, who always acted under Cæsar, and had never performed any signal services himself. Cicero has described the difference between them in a very beautiful manner in his second Philippic, thus speaking to Antony: "Are you in any thing to be compared to him? He had a genius, sagacity, memory, learning, care, thought, diligence; he had performed great things in war, though detrimental to the state; he had for many years designed to get the government into his hands, and obtained his end by much labour and many dangers; he gained over the ignorant multitude by public shows, buildings, congiaries, and feasts; obliged his friends by rewards, and his enemies by a show of clemency. In a word, he subjected a free state to slavery, partly through fear, and partly compliance. I can liken you to him for ambition of power; but in other things you are in no respect to be compared with him." By a comparison from the less to the greater, Cicero thus argues against Catiline: "Did the brave Scipio, when a private man, kill Tiberius Gracchus, for attempting to weaken the state; and shall we consuls bear with Catiline endeavouring to destroy the world by fire and sword?" The circumstances of these two cases were very different; and the comparison runs between a private man and a consul intrusted with the highest authority; between a design only to raise a tumult, and a plot to destroy the government: whence the orator justly infers, that what was esteemed lawful in one case, was much more so in the other. The like way of reasoning is sometimes used from other similitudes, which may be taken from things of all kinds, whether animate or inanimate. Of the former sort is that of Cicero speaking of Muræna, when candidate for the consulship, after he had himself gone through that office: "If it is usual (says he) for such persons as are safely arrived in port, to give those who are going out the best account they can with relation to the weather, pirates, and coasts; because thus nature directs us to assist those who are entering upon the same dangers which we ourselves have escaped: how ought I, who now after a great storm am brought within a near prospect of land, to be affected towards him, who, I perceive, must be exposed to the greatest tempests of the state?" He alludes to the late disturbances and tumults occasioned by the conspiracy of Catiline, which had been so happily suppressed by him in the time of his consulate. Of the latter kind is that of Quintilian: "As the ground is made better and more fruitful by culture, so is the mind by instruction." There is both a beauty and justness in this simile.

But comparisons are sometimes made between facts and

Disposition and other things, in order to infer some difference or opposition between them. In comparing two facts, on account of some disagreement and unlikeness, the inference is made from the difference between one and the other in that particular respect only. As thus: "Though it was not esteemed cruelty in Brutus to put his two sons to death, for endeavouring to betray their country; it might be so in Manlius, who put his son to death, only for engaging the enemy without orders, though he gained the victory." The difference between the two facts lies in the different nature of the crime. The sons of Brutus entered into a conspiracy to betray their country; and though they miscarried in it, yet the intention and endeavours they used to accomplish it were criminal in the highest degree. But young Manlius could only be charged with rashness. His design was honourable, and intended for the interest of his country; only it was irregular, and might have proved of ill consequence to military discipline. Now in all such cases, the force of the argument is the stronger the greater the difference appears. But the same facts which differ in one respect may agree in many others; as in the example here mentioned. Brutus and Manlius were both magistrates as well as fathers; they both killed their sons, and that for a capital crime by the Roman law. In any of which respects they may be compared in a way of similitude: as, "If Brutus might lawfully put his son to death for a capital crime, so might Manlius." But now contrary facts do not only differ in some certain respect, but are wholly opposite to each other; so that what is affirmed of the one must be denied of the other; and if one be a virtue, the other is a vice. Thus Cicero compares the conduct of Marcellus and Verres in a way of opposition. "Marcellus (says he), who had engaged, if he took Syracuse, to erect two temples at Rome, would not beautify them with the spoils he had taken: Verres, who had made no vows to Honour and Virtue, but to Venus and Cupid, endeavoured to plunder the temple of Minerva. The former would not adorn the gods with the spoils of other deities; the latter carried the ornaments of Minerva, a virgin, into the house of a strumpet." If therefore the conduct of Marcellus was laudable and virtuous, that of Verres must bear the contrary character. But this way of reasoning has likewise place in other respects. Thus Cicero, in the quarrel between Cæsar and Pompey, advised to peace from the difference between a foreign and domestic war: "That the former might prove beneficial to the state; but in the latter, whichever side conquered, the public must suffer." And thus the ill effects of intemperance may be shown in a way of opposition: "That as temperance preserves the health of the body, keeps up the vigour of the mind, and prolongs life; so excess must necessarily have the contrary effects.

Thus we have given a brief account of the principal ways of reasoning commonly made use of by orators. As to the disposition of arguments, or the order of placing them, some advise to put the weaker, which cannot wholly be omitted, in the middle; and such as are stronger, partly in the beginning, to gain the esteem of the hearers, and render them more attentive; and partly at the end, because what is last heard is likely to be retained longest: But if there are but two arguments, to place the stronger first, and then the weaker; and after that to return again to the former, and insist principally upon that. But this must be left to the prudence of the speaker, and the nature of the subject. Though to begin with the strongest, and so gradually descend to the weakest, can never be proper, for the reason last mentioned. Nor ought arguments to be crowded too close upon one another; for that takes off from their force, as it breaks in upon the attention of the hearers, and does not leave them sufficient time duly to consider them. Nor indeed should more be used than are necessary; because the fewer they are, the more easily they are remembered. And the observation of a great master of eloquence upon this subject is certainly very just, that *arguments ought rather to be weighed than numbered.*

## Chap. V. *Of Confutation.*

The forms of reasoning here are the same as have been already explained under *confirmation*. *Confutation*, however, is often the more difficult task; because he who is to prove a thing comes usually prepared: but he who is to confute it is frequently left to a sudden answer. For which reason, in *judicial* cases, Quintilian says, "It is as much easier to accuse than defend, as it is to make a wound than to heal it." Therefore, not only a good judgment, but a readiness of thought also, seems necessary for this province. But, in all disputes, it is of the greatest consequence to observe where the stress of the controversy lies. For without attending to this, persons may cavil about different matters without understanding each other, or deciding any thing. And in confutation, what the adversary has advanced ought carefully to be considered, and in what manner he has expressed himself. As to the things themselves, whether they immediately relate to the matter in dispute, or are foreign to it. Those things that are foreign to the subject may either be past over in silence, or in a very few words shown to be insignificant. And there ought likewise to be a distinction made between such things as relate to the subject, according to their importance. Those that appear to have no great weight should be slightly remarked. For to insist largely upon such matters is both tiresome to the hearers, and apt to bring the judgment of the speaker into question. And therefore things of that nature are generally better turned off with an air of neglect, a pungent question, or an agreeable jest, than confuted by a serious and laboured answer. But those things, which relate to the merits of the cause, may be confuted either by *contradicting* them, or by showing some *mistake* in the reasoning, or their *invalidity* when granted. 36 Forms of confutation the same with those of confirmation, but more difficult.

Things may be *contradicted* several ways. What is apparently false may be expressly *denied*. Thus Cicero in his defence of Cluentius: "When the accuser had said, that the man fell down dead after he had drunk off his cup, denies that he died that day." And things which the adversary cannot prove, may likewise be denied. Of which we have also an instance in Cicero, who first upbraids Mark Antony as guilty of a breach not only of good breeding, but likewise of friendship, for reading publicly a private letter he had sent him;



And

Disposition. And then adds, "But what will you say now, if I should deny that ever I sent you that letter? How will you prove it? By the hand-writing? In which I confess you have a peculiar skill, and have found the benefit of it. But how can you make it out? For it is in my secretary's hand. I cannot but envy your master who had so great a reward for teaching you to understand just nothing. For what can be more unbecoming not only an orator, but even a man, than for any one to offer such things, which if the adversary denies he has nothing more to say?" It is an handsome way of contradicting a thing, by showing that the adversary himself maintained the contrary. So when Oppius was charged with defrauding the soldiers of their provisions, Cicero refutes it, by proving, that the same persons charged Oppius with a design to corrupt the army by his liberality. An adversary is never more effectually silenced than when you can fasten contradictions upon him; for this is stabbing him with his own weapon. Sometimes a thing is not in express terms denied, but represented to be utterly incredible. And this method exposes the adversary more than a bare denial. So when some persons reproached Cicero with cowardice, and a shameful fear of death, he recites their reasons in such a manner, that any one would be inclined to think the charge entirely false. "Was it becoming me (says he) to expect death with that composedness of mind as some have imagined? Well, and did I then avoid it? Nay, was there any thing in the world that I could apprehend more desirable? Or when I had done the greatest things in such a crowd of ill minded persons about me, do you think banishment and death were not always in my view, and continually sounding in my ears as my certain fate, while I was so employed? Was life desireable when all my friends were in such sorrow, and myself in so great distress, deprived of all the gifts both of nature and fortune? Was I so unexperienced, so ignorant, so void of reason and prudence? Had I never seen or heard any thing in my whole life? Did all I had read and studied avail nothing? What! did not I know that life is short, but the glory of generous actions permanent? When death is appointed for all, does it not seem eligible, that life, which must be wrested from us, should rather be freely devoted to the service of our country, than reserved to be worn out by the decays of nature? Was not I sensible, there has been this controversy among the wisest men, that some say, the minds of men and their consciences utterly perish at death; and others, that the minds of wise and brave men are then in their greatest strength and vigour, when they are set free from the body? The first state is not greatly to be dreaded, to be void of sense: but the other, of enjoying larger capacities, is greatly to be desired. Therefore, since I always aimed at dignity, and thought nothing was worth living for without it; how should I, who am past the consulship, and did so great things in it, be afraid to die?" Thus far Cicero. There is likewise an ironical way of contradicting a thing, by retorting that and other things of the like nature upon the adverse party: Thus Cicero, in his oration against Vatinius, says: "You have objected to me, that I defended Cornelius, my old friend, and your acquaintance. But pray why should I not have defended him? Has Cornelius carried any law contrary to the omens? Has he violated Disposition. any law? Has he assaulted the consul? Did he take possession of a temple by force of arms? Did he drive away the tribune, who opposed the passing a law? Has he thrown contempt upon religion? Has he plundered the treasury? Has he pillaged the state? No, these, all these, are your doings." Such an unexpected return is sometimes of great service to abate the confidence of an adversary.

A second way of confutation is, by observing some *flaw* in the reasoning of the adverse party. We shall endeavour to illustrate this from the several kinds of reasoning treated of before under *confirmation*. And first, as to syllogisms; they may be refuted, either by showing some mistake in the premises, or that the conclusion is not justly deduced from them. So when the Clodian party contended, that Milo ought to suffer death for this reason, Because he had confessed that he had killed Clodius; that argument, reduced to a syllogism, would stand thus:

*He who confesses he has killed another, ought not to be allowed to see the light.*
*But Milo confesses this.*
*Therefore he ought not to live.*

Now the force of this argument lies in the major or first proposition; which Cicero refutes, by proving, that the Roman people had already determined contrary to what is there asserted: "In what city (says he) do these men dispute after this weak manner? In that wherein the first capital trial was in the case of the brave Horatius, who, before the city enjoyed perfect freedom, was saved by the suffrages of the Roman people, though he confessed that he killed his sister with his own hand." But when Cicero accused Verres for mal-administration in his government of Sicily, Hortensius, who defended him, being sensible the allegations brought against him could not be denied, had no other way left to bring him off, but by pleading his military virtues in abatement, which at that time were much wanted, and very serviceable to the state. The form of the argument was this:

*That the Romans then wanted good generals.*
*That Verres was such.*
*And consequently, that it was for the interest of the public that he should not be condemned.*

But Cicero, who knew his design, states the argument for him in his charge; and then answers it by denying the consequence, since the crimes of Verres were of so heinous a nature, that he ought by no means to be pardoned on the account of any other qualifications: Though indeed he afterwards refutes the minor or second proposition, and shows that he had not merited the character of a good general. Enthymems may be refuted, either by showing that the antecedent is false, or the consequent not justly inferred from it. As thus, with respect to the former case:

*A strict adherence to virtue has often proved detrimental.*
*Therefore virtue ought not constantly to be embraced.*

Here the antecedent may be denied. For virtue is alway beneficial to those who strictly adhere to it, both in the present satisfaction it affords them, and the future

Disposition. ture rewards they may certainly expect from it. And as to the latter case, in this manner:

*She is a mother,*
*Therefore she loves her children.*

Now as the certainty of that inference depends upon this general assertion, That all mothers love their children, which is not true, the mistake of the reasoning may be shown from the instance of Medea and others, who destroyed their own children. As to *induction* and *example*, by which the truth or equity of a thing is proved from its likeness to one or more other things; the reasoning in either is invalid, if the things so compared can be shown not to have that similitude or agreement on which the inference is founded. One instance therefore may serve for both. As when Cicero, after the death of Cæsar, pleaded for the continuance of his laws, but not of those which were made afterwards by Mark Antony: Because, though both were in themselves invalid, and impositions upon the public liberty; yet some of Cæsar's were useful, and others could not be set aside without disturbance to the state, and injuring particular persons; but those of Antony were all detrimental to the public.

The last method of *confutation* before-mentioned was, when the orator does in some sense *grant* the adversary his argument, and at the same time shows its *invalidity*. And this is done by a variety of ways, according to the different nature of the subject. Sometimes he allows what was said may be true; but pleads, that what he contends for is necessary. This was the method by which Hortensius proposed to bring off Verres, as we have already shown from Cicero, whose words are these, addressing himself to the judges: "What shall I do? which way shall I bring in my accusation? where shall I turn myself? for the character of a brave general is placed like a wall against all the attacks I can make. I know the place, I perceive where Hortensius intends to display himself. He will recount the hazards of war, the necessities of the state, the scarcity of commanders; and then he will intreat you, and do his utmost to persuade you not to suffer the Roman people to be deprived of such a commander upon the testimony of the Sicilians, nor the glory of his arms to be sullied by a charge of avarice." At other times the orator pleads, that although the contrary opinion may seem to be attended with advantage, yet that his own is more just, or honourable. Such was the case of Regulus, when his friends endeavoured to prevail with him to continue at Rome, and not return to Carthage, where he knew he must undergo a cruel death. But as this could not be done without violating his oath, he refused to hearken to their persuasions. Another way of confutation is, by retorting upon the adversary his own argument. Thus Cicero, in his defence of Ligarius, says: "You have, Tubero, that which is most desirable to an accuser, the confession of the accused party; but yet such a confession, that he was on the same side that you, Tubero, chose yourself, and your father too, a man worthy of the highest praise. Wherefore, if there was any crime in this, you ought first to confess your own before you attempt to fasten any upon Ligarius." The orator takes this advantage where an argument proves too much, that is, more than the person designed it for, who made use of it. Not much unlike this is what they call *inversion*, by which the orator shows, that the reasons offered by the opposite party make for him. So when Cæcilius urged, that the province of accusing Verres ought to be granted to him, and not to Cicero, because he had been his treasurer in Sicily at the time those crimes were committed with which he was charged, and consequently knew most of that affair; Cicero turns the argument upon him, and shows, for that very reason he was the most unfit of any man to be intrusted with his prosecution; since having been concerned with him in his crimes, he would certainly do all in his power to conceal or lessen them. Again, sometimes the charge is acknowledged, but the crime shifted off to another. Thus, when Sextius was accused of sedition, because he had got together a body of gladiators, and brought them into the forum, where a warm engagement happened between them and Clodius's faction; Cicero owns the fact, but charges the crime of sedition upon Clodius's party in being the aggressors. Another method made use of for the same purpose is to alleviate the charge, and take off the force of it, by showing, that the thing was not done with that intention which the adversary insinuates. Thus Cicero, in his defence of King Dejotarus, owns he had raised some forces, though not to invade the Roman territories, as had been alledged, but only to defend his own borders, and send aid to the Roman generals. Disposition.

We have hitherto been speaking of the methods of confutation used by orators, in answering those arguments which are brought by the contrary party. But sometimes they raise such objections themselves to what they have said, as they imagine may be made by others; which they afterwards answer, the better to induce their hearers to think that nothing considerable can be offered against what they have advanced, but what will admit of an easy reply. Thus, when Cicero, at the request of the Sicilians, had undertaken the accusation of Verres, it came under debate, whether he, or Cæcilius, who had been Verres's quæstor in Sicily, should be admitted to that province. Cicero, therefore, in order to set him aside, among other arguments, shows his incapacity for such an undertaking, and for that end recounts at large the qualifications necessary for an orator. Which he represents to be so many and great, that he thought it necessary to start the following objection to what he had himself said upon that subject. "But you will say perhaps, Have you all these qualifications?" To which he thus replies: "I wish I had; but it has been my constant study from my youth to gain them. And if, from their greatness and difficulty, I have not been able to attain them, who have done nothing else through my whole life; how far, do you imagine, you must be from it, who never thought of them before; and even now, when you are entering upon them, have no apprehension what, and how great, they are?" This is an effectual way of defeating an adversary, when the objection is well founded, and clearly answered. But we shall have occasion to consider this matter more largely hereafter, under the figure *prolepsis*, to which it properly relates.

Chap.

### Chap. VI. *Of the Conclusion.*

37
The conclusion is a recapitulation and address to the passions.

Rhetoricians make the *conclusion* of a discourse to consist of two parts: *recapitulation*, and *an address to the passions*.

1. *Recapitulation* is a summary account of what the speaker has before offered in maintenance of his subject; and is designed both to refresh the memory of the hearers, and to bring the principal arguments together into a narrow compass, that they may appear in a stronger light. Now there are several things necessary to a good repetition.

And first, it must be short and concise; since it is designed to refresh the memory, and not to burden it. For this end, therefore, the chief things only are to be touched upon; those on which the cause principally depends, and which the orator is most desirous should be regarded by his hearers. Now these are, The general heads of the discourse, with the main arguments brought to support them. But either to insist particularly upon every minute circumstance, or to enlarge upon those heads which it may be thought proper to mention, carries in it not so much the appearance of a repetition, as of a new discourse.

Again, it is convenient in a repetition to recite things in the same order in which they were at first laid down. By this means the hearers will be enabled much better to keep pace with the speaker as he goes along; and if they happen to have forgot any thing, they will the more readily recal it. And besides, this method appears most simple and open, when the speaker reviews what he has said in the same manner it was before delivered, and sets it in the clearest light for others to judge of it. But though a repetition contains only the same things which had been more largely treated of before; yet it is not necessary they should be expressed in the same words. Nay, this would many times be tiresome and unpleasant to the hearers; whereas a variety of expression is grateful, provided the sense be the same. Besides, every thing ought now to be represented in the strongest terms, and in so lively a manner, as may at the same time both entertain the audience, and make the deepest impression upon their minds. We have a very exact and accurate example of repetition in Cicero's oration for Quintius. Cicero was then a young man, and seems to have kept more closely to the rules of art, than afterwards when, by use and practice, he had gained a greater freedom of speaking. We formerly cited the partition of this speech, upon another occasion, which runs thus: "We deny, Sextus Nevius, that you were put into the possession of the estate of P. Quintius, by the prætor's edict. This is the dispute between us. I will therefore show, first, that you had no just cause to apply to the prætor for the possession of the estate of P. Quintius; then, that you could not possess it by the edict; and lastly, that you did not possess it. When I have proved these three things, I will conclude." Now Cicero begins his conclusion with a repetition of those three heads, and a summary account of the several arguments he made use of under each of them. But they are too long to be here exhibited. In his oration for the Manilian law, his repetition is very short. He proposed in the partition to speak to three things: The nature of the war against king Mithridates, the greatness of it, and what sort of general was proper to be intrusted with it. And when he has gone through each of these heads, and treated upon them very largely, he reduces the substance of what he has said to this general and short account: "Since therefore the war is so necessary, that it cannot be neglected; and so great, that it requires a very careful management; and you can intrust it with a general of admirable skill in military affairs, of singular courage, the greatest authority, and eminent success: do you doubt to make use of this so great a blessing, conferred and bestowed upon you by heaven, for the preservation and enlargement of the Roman state?" Indeed this repetition is made by Cicero, before he proceeds to the confutation; and not at the end of his discourse, where it is usually longer and more particular: however, this may serve to show the nature of such a recital.

But sometimes a repetition is made, by running a comparison between the speaker's own arguments and those of the adverse party; and placing them in opposition to each other. And this method Cicero takes in the conclusion of his third oration upon the Agrarian law. And here sometimes the orator takes occasion to find fault with his adversary's management, in these and such like expressions: "This part he has entirely dropt. To that he has given an invidious turn, or a false colouring. He leaves arguments, and flies to intreaties; and not without good reason, if we consider the weakness of his cause."

But when the discourse is very long, and the arguments insisted on have been many, to prevent the hearers growing out of patience by a more particular recital, the orator sometimes only just mentions such things, which he thinks of least consequence, by saying, that he omits or passes over them, till he comes to what is of greater moment, which he represents more fully. This method Cicero has taken in his defence of Cluentius; where, having run over several lesser heads in the manner now described, he then alters his expression, and introduces what was of more importance, by saying, "What I first complain of, is that wickedness, which is now discovered." And so he proceeds more particularly to recite those things which immediately related to Cluentius. And this is what the writers upon this art call *preterition*. But this much may serve for repetition or recapitulation.

2. We now proceed to the other part of the conclusion, which consists in an *address to the passions*. Indeed the orator sometimes endeavours occasionally to work upon the passions of his hearers in other parts of his discourse, but more especially in the conclusion, where he is warmest himself, and labours to make them so. For the main design of the introduction is to conciliate the hearers, and gain their attention; of the narration, proposition, and confirmation, to inform them; and of the conclusion, to move them. And therefore, to use Quintilian's words, "Here all the springs of eloquence are to be opened. It is here we secure the minds of the hearers, if what went before was well managed. Now we are past the rocks and shallows, all the sails may be hoisted. And as the greatest part of the conclusion consists in illustration, the most pompous language and strongest figures have place

Disposition place here." Now the passions, to which the orator more particularly addresses, differ according to the nature of the discourse. In demonstrative orations, when laudatory,—love, admiration, and emulation, are usually excited; but in invectives, hatred, envy, and contempt. In deliberative subjects, either the hope of gratifying some desire is set in view, or the fear of some impending evil. And in judicial discourses, almost all the passions have place, but mor especially resentment and pity; insomuch that most of the ancient rhetoricians mention only these two. But having treated upon the nature of the passions, and the methods suited both to excite and allay them, in a former chapter, we shall at present only add a few general observations, which may not be improper in this place, where the skill of the orator in addressing to them is more especially required.

The orator will observe what circumstances either of things, or persons, or both, will furnish him with motives proper to apply to those passions he desires to excite in the minds of his hearers. Thus Cicero, in his orations for Plancus and Sylla, moves his hearers from the circumstances of the men; but in his accusation of Verres, very frequently from the barbarity and horrid nature of his crimes; and from both, in his defence of Quintius.

But the same passion may be excited by very different methods. This is plain from the writings of those Roman satyrists which are yet extant; for they have all the same design, and that is to engage men to a love of virtue, and hatred of vice: but their manner is very different, suited to the genius of each writer. Horace endeavours to recommend virtue, by laughing vice out of countenance; Persius moves us to an abhorrence and detestation of vice, with the gravity and severity of a philosopher; and Juvenal, by open and vehement invectives. So orators make use of all these methods in exciting the passions; as may be seen by their discourses, and particularly those of Cicero. But it is not convenient to dwell long upon the same passion. For the image thus wrought up in the minds of the hearers does not last a great while; but they soon return to reflection. When the emotion, therefore, is once carried as high as it well can be, they should be left under its influence, and the speaker proceed to some new matter, before it declines again.

Moreover, orators sometimes endeavour to raise contrary passions to each other, as they are concerned for opposite parties. So the accuser excites anger and resentment, but the defendant pity and compassion. At other times, one thinks it sufficient to allay and take off that passion which the other has raised, and bring the hearers to a calm and sedate consideration of the matter before them.

But this especially is to be regarded, that the orator express the same passion himself with which he endeavours to affect others; and that not only in his action and voice, but likewise in his language: and therefore his words, and manner of expression, should be suited to that perturbation and disorder of mind which he designs to represent. However, a decency and propriety of character is always carefully to be observed; for, as Cicero very well remarks, "A neglect of this is not only very culpable in life, but likewise in discourse. Nor do the same things equally become every speaker, or every audience; nor every time, and every place." And therefore he greatly commends that painter, who, designing to represent in a picture the sacrifice of Ephigenia, Agamemnon's daughter, drew Calchas the priest with a sad countenance; Ulysses, her father's great friend, more dejected; and her uncle Menelaus, most disconsolate; but threw a veil over the face of Agamemnon himself, as being unable to express that excess of sorrow which he thought was proper to appear in h's countenance. And this justness of character is admirably well observed by Cicero himself, in his defence of Milo; for as Milo was always known to be a man of the greatest resolution, and most undaunted courage, it was very improper to introduce him (as the usual method then was in capital cases) moving pity, and begging for mercy. Cicero therefore takes this part upon himself; and what he could not do with any propriety in the person of Milo, he performs in his own, and thus addresses the judges: "What remains, but that I intreat and beseech you, that you would show that compassion to this brave man, for which he himself does not solicit, but I, against his inclination, earnestly implore and request. Do not be less inclined to acquit him, if in this our common sorrow, you see no tear fall from Milo's eyes; but perceive in him the same countenance, voice, and language, as at other times, steady and unmoved. Nay, I know not whether for this reason, you ought not much sooner to favour him: For if, in the contests of gladiators (persons of the lowest condition and fortune in life), we are wont to be displeased with the timorous and suppliant, and those who beg for their life; but interpose in favour of the brave and courageous, and such as expose themselves to death; and we show more compassion to those who do not sue for it, than to those who do: with how much greater reason ought we to act in the same manner towards the bravest of our fellow citizens?" And as these words were agreeable to his own character, while soliciting in behalf of another; so, immediately after, he introduces Milo speaking like himself, with a generous and undaunted air: "These words of Milo (says he) quite sink and dispirit me, which I daily hear from him. Farewel, farewel, my fellow citizens, farewel! may you be happy, flourish, and prosper; may this renowned city be preserved, my most dear country, however it has treated me; may it continue in peace, though I cannot continue in it, to whom it owes its peace. I will retire, I will be gone."

But as persons are commonly more affected with what they see than with what they hear, orators sometimes call in the assistance of that sense in moving the passions. For this reason it was usual among the Romans, in judicial cases, for accused persons to appear with a dejected air and a sordid garb, attended by their parents, children, or other relations and friends, with the like dress and aspect; as likewise to show their scars, wounds, bloody garments, and other things of the like nature, in open court So when, upon the death of Cæsar, Mark Antony harangued the populace, he at the same time exposed to their view the garment

Disposition. garment in which he was stabbed, fixed upon a pole; at which sight they were so enraged, that immediately they ran with lighted torches to set fire to the houses of the conspirators. But this custom at last became so common, and was sometimes so ill conducted, that the force of it was greatly abated, as we learn from Quintilian. However, if the Romans proceeded to an excess on the one hand, the strictness of the Areopagites at Athens may perhaps be thought too rigid on the other; for in that court, if the orator began to say any thing which was moving, an officer immediately stood up and bade him be silent. There is certainly a medium between these two extremes, which is sometimes not only useful, but even necessary: for, as Quintilian very justly says, "It is necessary to apply to the passions, when those things which are true, just, and of common benefit, cannot be come at any other way."

## Chap. VII. *Of Digression, Transition, and Amplification.*

38

Digression, transition, and amplification, defined and explained.

The number, order, and nature of the parts which constitute a complete and regular oration, we have endeavoured to explain in several preceding chapters. But there are two or three things yet remaining, very necessary to be known by an orator, which seems most properly to come under the second branch of his art.— And these are, *Digression, Transition, and Amplification.*

I. *Digression*, as defined by Quintilian, is, "A going off from the subject we are upon to some different thing, which may however be of service to it." We have a very beautiful instance of this in Cicero's defence of Cœlius, who was accused of having first borrowed money of Clodia, and then engaging her servants to poison her. Now, as the proof of the fact depended upon several circumstances, the orator examines them separately; and shows them to be all highly improbable. "How (says he) was the design of this poison laid? Whence came it? how did they get it? by whose assistance, to whom, or where, was it delivered?" Now to the first of these queries he makes the accuser give this answer "They say Cœlius had it at home, and tried the force of it upon a slave provided on purpose, whose sudden death proved the strength of the poison." Now as Cicero represents the whole charge against Cœlius as a fiction of Clodia, invented out of revenge for some slights he had put upon her; to make this the more probable, he insinuates that she had poisoned her husband, and takes this opportunity to hint it, that he might show how easy it was for her to charge another with poisoning a servant, who had done the same to her own husband But not contented with this, he steps out of his way, and introduces some of the last words of her husband Metellus, to render the fact more barbarous and shocking, from the admirable character of the man. "O immortal gods! why do you sometimes wink at the greatest crimes of mankind, or delay the punishment of them to futurity! For I saw, I myself saw (and it was the most doleful scene of my whole life) when Q. Metellus was taken from the bosom of his country; and when he, who thought himself born to be serviceable to this state, within three days after he had appeared with such advantage in the senate, in the forum, and everywhere in public, was snatched from us in the flower of his age, and prime of his strength and vigour. At which time, when he was about to expire, and his mind had lost the sense of other things, still retaining a concern for the public, he looked upon me, as I was all in tears, and intimated in broken and dying words, how great a storm hung over the city and threatened the whole state; often striking the wall which separated his house from that of Quintus Catulus, and frequently calling both upon him and me, and seeming to grieve not so much at the approach of his own death, as that both his country and I should be deprived of his assistance. Had he not been wickedly taken off on a sudden, how would he after his consulship have withstood the fury of his kinsman Publius Clodius, who, while in that office, threatened, in the hearing of the senate, to kill him with his own hand, when he first began to break out? And will this woman dare to come out of those doors, and talk of the force of poison? will not she fear, lest the house itself should speak the villany? will not she dread the conscious walls, nor that sad and mournful night? But I return to the accusation." And then he proceeds to consider and refute the several circumstances of the accusation. All this was no part of his argument; but having mentioned the charge of poison, he immediately takes occasion to introduce it, in order to excite the indignation of the hearers against Clodia, and invalidate the prosecution as coming from a person of her character. Digression cannot properly be said to be a necessary part of a discourse; but it may sometimes be very convenient, and that upon several accounts.

As first, when a subject is of itself flat and dry, or requires close attention, it is of use to relieve and unbend the mind by something agreeable and entertaining. For which reason Quintilian observes, that the orators of his time generally made an excursion in their harangues upon some pleasing topic, between the narration and the proof. But he condemns the practice as too general; for while they seemed to think it necessary, it obliged them sometimes to bring in things trifling and foreign to the purpose. Besides, a digression is confined to no one part of a discourse, but may come in anywhere, as occasion offers; provided it fall in naturally with the subject, and be made some way subservient to it. We never meet with it in Cicero, without some evident and good reason. So in his prosecution of Verres for his barbarous and inhuman outrages against the Sicilians, he takes an occasion to launch out in a beautiful description of the island, and to recount the advantages which accrued from it to the Romans. His subject did not necessarily lead him to this, but his view in it was to heighten and aggravate the charge against Verres.

Again, as a *digression* ought not to be made without sufficient reason, so neither should it be too frequent. And he who never does it but where it is proper and useful, will not often see occasion for it. Frequently to leave the subject, and go off to other things, breaks the thread of the discourse, and is apt to introduce confusion Indeed some kinds of writing admit of a more frequent use of digressions than others. In history they are often very serviceable. For as that

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that consists of a series of facts, and a long continued narrative without variety, is apt to grow dull and tedious; it is necessary at proper distances to throw in something entertaining, in order to enliven it, and keep up the attention. And accordingly we find the best historians often embellish their writings with descriptions of cities, rivers, and countries, as likewise with the speeches of eminent persons upon important occasions, and other ornaments, to render them the more pleasing and delightful. Poets take a still greater liberty in this respect; for as their principal view is most commonly to please, they do not attend so closely to connection; but as an image offers itself, which may be agreeably wrought up, they bring it in, and go off more frequently to different things, than other writers.

Another property of a *digression* is, that it ought not to be too long, lest the hearers forget what preceded, before the speaker returns again to his subject

For a digression being no principal part of a discourse, nor of any further use than as it serves some way or other to enforce or illustrate the main subject; it cannot answer this end, if it be carried to such a length, as to cause that either to be forgotten or neglected. And every one's memory will not serve him to connect together two parts of a discourse, which lie at a wide distance from each other. The better therefore to guard against this, it is not unusual with orators, before they enter upon a digression of any considerable length, to prepare their hearers by giving them notice of it, and sometimes desiring leave to divert a little from the subject. And so likewise at the conclusion they introduce the subject again by a short transition. Thus Cicero in the example cited above, when he has finished his digression concerning the death of Metellus, proceeds to his subject again with these words: "But I return to the accusation."

Indeed we find orators sometimes, when sore pressed, and the cause will not bear a close scrutiny, artfully run into digressions with a design to divert the attention of the hearers from the subject, and turn them to a different view. And in such cases, as they endeavour to be unobserved, so they do it tacitly without any transition or intimation of their design; their business being only to get clear of a difficulty, till they have an opportunity of entering upon some fresh topic.

39 Transitions often used on various occasions.

II. *Transitions* are often used not only after a digression, but likewise upon other occasions. A transition is, "A form of speech, by which the speaker in a few words tells his hearers both what he has said already, and what he next designs to say." Where a discourse consists of several parts, this is often very proper in passing from one to another, especially when the parts are of a considerable length; for it assists the hearers to carry on the series of the discourse in their mind, which is a great advantage to the memory. It is likewise a great relief to the attention, to be told when an argument is finished, and what is to be expected next. And therefore we meet with it very frequently in history. But we consider it at present only as made use of by orators. Cicero, in his second oration against Catiline, who had then left Rome, having at large described his conduct and designs, he adds: "But why do I talk so long concerning one enemy, and such an one; who owns himself an enemy, and whom I do not fear, since, what I always desired, there is now a wall between us; and say nothing of those, who conceal themselves, who remain at Rome, and among us?" And then he proceeds to give an account of the other conspirators.

But sometimes, in passing from one thing to another, a general hint of it is thought sufficient to prepare the hearers without particularly specifying what has been said, or is next to follow. Thus Cicero in his second Philippic says, "But those things are old, this is yet fresh." And again: "But I have insisted too long upon trifles, let us come to things of greater moment." And at other times, for greater brevity, the transition is imperfect, and mention made only of the following head, without any intimation of what has been said already. As in Cicero's defence of Muræna, where he says: "I must now proceed to the third part of my oration concerning the charge of bribery." And soon after: I come now to Cato, who is the support and strength of this charge."

III. The third and last head is, *Amplification*. Now by amplification is meant, not barely a method of enlarging upon a thing; but so to represent it in the fullest and most comprehensive view, as that it may in the liveliest manner strike the mind and influence the passions. Cicero, speaking of this, calls it *the greatest commendation of eloquence;* and observes, "that it consists not only in magnifying and heightening a thing, but likewise in extenuating and lessening it." But though it consists of these two parts, and may be applied either way; yet to amplify, is not to set things in a false light, but to paint them in their just proportion and proper colours, suitable to their nature and qualities. Rhetoricians have observed several ways of doing this. 40 Amplification defined and explained.

One is to ascend from a particular thing to a general. Thus Cicero, in his defence of Archias, having commended him as an excellent poet, and likewise observed, that all the liberal arts have a connection with each other, and a mutual relation between them, in order to raise a just esteem of him in the minds of his hearers, takes occasion to say many things in praise of polite literature in general, and the great advantages that may be received from it. "You will ask me (says he), why we are so delighted with this man? Because he supplies us with those things which both refresh our minds after the noise of the forum, and delight our ears when wearied with contention. Do you think we could either be furnished with matter for such a variety of subjects, if we did not cultivate our minds with learning; or bear such a constant fatigue, without affording them that refreshment? I own I have always pursued these studies; let those be ashamed, who have so given up themselves to learning, as neither to be able to convert it to any common benefit, nor discover it in public. But why should it shame me, who have so lived for many years, that no advantage or ease has ever diverted me, no pleasure allured me, nor sleep retarded me from this pursuit. Who then can blame me, or who can justly be displeased with me, if I have employed that time in reviewing these studies, which has been spent by others in managing their affairs, in the celebration of festivals, or other diversions in refreshments of mind and body,

Disposition. body, in unseasonable banquets, in dice, or tennis? And this ought the rather to be allowed me, because my ability as an orator has been improved by those pursuits, which, such as it is, was never wanting to assist my friends. And if it be esteemed but small, yet I am sensible from what spring I must draw those things which are of the greatest importance." With more to the same purpose; from which he draws this inference: "Shall I not therefore love this man? shall I not admire him? shall I not by all means defend him?"

A contrary method to the former is, to descend from a general to a particular. As if any one, while speaking in commendation of eloquence, should illustrate what he says from the example of Cicero, and show the great services he did his country, and the honours he gained to himself, by his admirable skill in oratory. Our common way of judging of the nature of things is from what we observe in particular instances, by which we form general notions concerning them. When therefore we consider the character of Cicero, and the figure he made in the word, it leads us to conclude, there must be something very admirable in that art by which he became so celebrated. And this method he has taken himself in his oration for the Manilian law, where having first intimated the scarcity of good generals at that time among the Romans, he then describes the virtues of a complete commander as a proof of it, and shows how many and great qualifications are necessary to form such a character, as courage, prudence, experience, and success: all which he afterwards applies to Pompey.

A third method is by an enumeration of parts. So when Cicero, upon the defeat of Mark Antony before Mutina, proposed that a funeral monument should be erected in honour of the soldiers who were killed in that battle, as a comfort to their surviving relations; he does it in this way, to give it the greater weight: "Since (says he) the tribute of glory is paid to the best and most valiant citizens by the honour of a monument, let us thus comfort their relations, who will receive the greatest consolation in this manner; their parents who produced such brave defenders of the state; their children who will enjoy these domestic examples of fortitude; their wives, for the loss of such husbands, whom it will be more fitting to extol than lament; their brethren, who will hope to resemble them no less in their virtues than their aspect. And I wish we may be able to remove the grief of all these by our resolutions." Such representations greatly enlarge the image of a thing, and afford the mind a much clearer view of it than if it were contracted into one single proposition.

Again, another method not much unlike the former is, when any thing is illustrated from a variety of causes. Thus Cicero justifies his behaviour in retiring, and not opposing his enemies, when they spirited up the mob in order to banish him, from the following reasons, which at that time determined him to such a conduct: "When (says he) unless I was given up, so many armed fleets seemed ready to attack this single ship of the state, tossed with the tempests of seditions and discords, and the senate was now removed from the helm; when banishment, murder, and outrage, were threatened; when some, from an apprehension of their own danger, would not defend me; others were Disposition. incited by an inveterate hatred to all good men, others thought I stood in the way, others took this opportunity to express their resentment, others envied the peace and tranquillity of the state; and upon all these accounts I was particularly struck at: should I have chosen rather to oppose them (I will not say to my own certain destruction, but to the greatest danger both of you and your children), than alone to submit to and undergo what threatened us all in common?" Such a number of reasons brought together, must set a thing in a very strong and clear light.

The like may be said of a number and variety of effects. Thus Cicero describes the force and excellence of oratory from its great and surprising effects, when he says, "Nothing seems to be more excellent, than by discourse to draw the attention of a whole assembly, delight them, and sway their inclinations different ways at pleasure. This, in every free state, and especially in times of peace and tranquillity, has been always in the highest esteem and reputation. For what is either so admirable, as for one only, or a very few, out of a vast multitude, to be able to do that which all have a natural power of doing? or so delightful to hear, as a judicious and solid discourse in florid and polite language? or so powerful and grand, as to influence the populace, the judges, the senate, by the charms of eloquence? Nay, what is so noble, so generous, so munificent, as to afford aid to supplicants, to support the afflicted, give safety, deliver from dangers, and preserve from exile? Or what is so necessary as to be always furnished with arms to guard yourself, assert your right, or repel injuries? And, not to confine our thoughts wholly to the courts of justice or the senate, what is there in the arts of peace more agreeable and entertaining than good language and a fine way of speaking? For it is this especially wherein we excel other animals, that we can discourse together, and convey our thoughts to each other by words. Who therefore would not esteem, and in a particular manner endeavour to surpass others in that wherein mankind principally excels brute beasts? But to proceed to its chief advantages: What else would have drawn men into societies or taken them off from a wild and savage life, and soften them into a polite and civilized behaviour; or, when settled in communities, have restrained them by laws?" Who but, after such a description, must conceive the strongest passion for an art attended with so many great and good effects?

A thing may likewise be illustrated by its opposite. So the blessings and advantages of peace may be recommended from the miseries and calamities of war; and thus Cicero endeavours to throw contempt upon Catiline and his party by comparing them with the contrary side: "But if, omitting all these things with which we abound, and they want, the senate, the knights, the populace, the city, treasury, revenues, all Italy, the provinces, and foreign nations; if, I say, omitting these things, we compare the causes themselves in which each side is engaged, we may learn from thence how despicable they are.—For on this side modesty is engaged, on that impudence; on this chastity, on that lewdness; on this integrity, on that fraud; on this piety, on that profaneness; on this con-

Elocution. constancy, on that fury; on this honour, on that baseness; on this moderation, on that unbridled passion: In a word, equity, temperance, fortitude, prudence, and all virtues, contend with injustice, luxury, cowardice, rashness, and all vices; plenty with want; reason with folly; sobriety with madness; and, lastly, good hope with despair. In such a contest, did men desert us, would not heaven ordain that so many and so great vices should be defeated by these most excellent virtues?"

Gradation is another beautiful way of doing this. So when Cicero would aggravate the cruelty and barbarity of Verres for crucifying a Roman citizen, which was a sort of punishment only inflicted upon slaves, he chooses this way of doing it. "It is a crime (says he) to bind a Roman citizen, wickedness to whip him, and a sort of parricide to kill him; what then must I call it to crucify him? No name can sufficiently express such a villany." And the images of things may be thus heightened, either by ascending, as in this instance; or descending, as in that which follows, relating to the same action of Verres: "Was I not to complain of or bewail these things to Roman citizens, nor the friends of our state, nor those who had heard of the Roman name; nay, if not to men, but beasts; or, to go yet further, if in the most desert wilderness, to stones and rocks; even all mute and inanimate creatures would be moved by so great and heinous cruelty."

And, to name no more, facts may be amplified from their circumstances; as time, place, manner, event, and the like. But instances of this would carry us too far; and therefore we shall only add, that as the design of *amplification* is not barely to prove or evince the truth of things, but also to adorn and illustrate them, it requires a florid and beautiful style, consisting of strong and emphatical words, flowing periods, harmonious numbers, lively tropes, and bright figures. But the consideration of these things come under the Third Part of Oratory, upon which we are now to enter.

# PART III. OF ELOCUTION.

ELOCUTION directs us to suit both the words and expressions of a discourse to the nature of the subject, or to speak with propriety and decency. This faculty is in one word called *eloquence*; and those persons who are possessed of it are therefore styled *eloquent*.

*Elocution* is twofold, general and particular. The former treats of the several properties and ornaments of language in common; the latter considers them as they are made use of to form different sorts of style.

## I. GENERAL ELOCUTION.

41 General elocution defined.

THIS, according to rhetoricians, consists of three parts; *Elegance*, *Composition*, and *Dignity*. A discourse which has all these properties suitably adjusted, must, with respect to the language, be perfect in its kind, and delightful to the hearers.

### CHAP. I. *Of Elegance.*

ELEGANCE consists in two things, *Purity* and *Perspicuity*: And both these, as well with respect to single words, as their construction in sentences. These properties in language give it the name of *elegant*, for a like reason that we call other things so which are clean and neat in their kind. But in the common use of our tongue, we are apt to confound *elegance* with *eloquence*; and say, *a discourse is elegant*, when we mean by the expression, that it has all the properties of fine language.

#### § 1. *Purity.*

42 Purity explained and illustrated.

BY this we are to understand the choice of such words and phrases as are suited and agreeable to the use of the language in which we speak: And so grammarians reduce the faults they oppose to it to two sorts, which they call *barbarism* and *solecism*; the former of which respects single words, and the latter their construction. But we shall consider them jointly, and in a manner different from grammarians; for with them all words are esteemed pure which are once adopted into a language, and authorised by use. And as to phrases, or forms of expression, they allow them all the same claim, which are agreeable to the analogy of the tongue. But in oratory, neither all words nor all expressions are so called which occur in language; but such only as come recommended by the authority of those who speak or write with accuracy and politeness. Indeed it is a common saying *that we should think with the learned, and speak with the vulgar*. But the meaning of that expression is no more than that we should speak agreeably to the common usage of the tongue, that every one may understand us; and not choose such words or expressions as are either difficult to be understood, or may carry in them an appearance of affectation and singularity. But in order to set this matter in a clearer light, we shall hear recount the principal things which vitiate the purity of language.

And first, it often happens, that such words and forms of speaking as were introduced by the learned are afterwards dropped by them as mean and sordid, from a seeming baseness contracted by vulgar use. For polite and elegant speakers distinguish themselves by their discourse, as persons of figure do by their garb; one being the dress of the mind, as the other is of the body. And hence it comes to pass, that both have their different fashions, which are often changed; and as the vulgar affect to imitate those above them in both, this frequently occasions an alteration when either becomes too trite and common. But beside these sordid words and expressions, which are rendered so by the use of the vulgar, there is another sort first introduced by them, which is carefully to be avoided by all those who are desirous to speak well. For the vulgar have their peculiar words and phrases, suited to their circumstances, and taken from such things as usually occur in their way of life. Thus in the old comedians, many things are spoken by servants, agreeable to their character, which would be very

Elocution. very unbecoming from the mouth of a gentleman. And we cannot but daily observe the like instances among ourselves.

Again, this is common to language with all other human productions, that it is in its own nature liable to a constant change and alteration. For, as Horace has justly observed,

> All human works shall waste;
> Then how can feeble words pretend to last?

Nothing could ever please all persons, or at least for any length of time. And there is nothing from which this can less be expected than language. For as the thoughts of men are exceedingly various, and words are the signs of their thoughts, they will be constantly inventing new signs, or use them by, in order to convey their ideas with more clearness, or greater beauty. If we look into the different ages of the Latin writers, what great alterations and changes do we find in their language? How few now understand the remaining fragments of the *twelve tables*? Nay, how many words do we meet with even in Plautus, the meaning of which has not yet been fixed with certainty by the skill of the best critics? And if we consider our own language, it will appear to have been in a manner entirely changed from what it was a few ages since. To mention no others, our celebrated Chaucer is to most persons now almost unintelligible, and wants an expositor. And even since our own memory, we cannot but have observed, that many words and expressions, which a few years ago were in common use, are now in a manner laid aside and antiquated; and that others have constantly succeeded, and daily do succeed, in their room. So true is that observation of the same poet:

> Some words that have or else will feel decay
> Shall be restor'd, and come again in play;
> And words now fam'd shall not be fancied long;
> They shall not please the ear, nor move the tongue:
> As use shall these approve, and those condemn;
> Use, the sole rule of speech, and judge supreme.

We must therefore no less abstain from antiquated or obsolete words and phrases, than from sordid ones. Though all old words are not to be thought antiquated. By the former we mean such as, though of an ancient standing, are not yet entirely disused nor their signification lost. And from the use of these we are not to be wholly debarred, especially when they appear more significant than any others we can fix upon. But as to phrases or expressions, greater caution seems still necessary: and such as are old should doubtless, if at all, be used more sparingly. The Latin tongue was brought to its greatest perfection in the reign of Augustus, or somewhat sooner; and he himself studied it very carefully. For, as Suetonius tells us, "He applied himself to eloquence, and the study of the liberal arts, from his childhood, with great diligence and labour. He chose a manner of speaking which was smooth and elegant; he avoided the ill savour, as he used to call it, of antiquated words; and he was wont to blame Tiberius for his affectation of them." In our own language, such words are to be esteemed antiquated, which the most polite persons have dropped, both in their discourse and writings; whose example we should follow, unless we would be thought to converse rather with the dead than the living.

But further: As on the one hand we must avoid obsolete words and phrases; so, on the other, we should refrain from new ones, or such whose use has not yet been sufficiently established, at least among those of the best taste. Words may be considered as new in two respects; either when they are first brought into a language, or when they are used in a new sense. As the former of these may sometimes leave us in the dark by not being understood, so the latter are most apt to mislead us; for when we hear a word that has been familiar to us, we are presently led to fix that idea to it with which it has usually been attended. And therefore, in both cases, some previous intimation may be necessary. Cicero, who perhaps enlarged the furniture of the Roman tongue more than any one person besides, appears always very cautious how he introduces any thing new, and generally gives notice of it when he attempts it, as appears in many instances scattered through his works. What bounds we are now to fix to the purity of the Latin tongue, in the use of it, the learned are not well agreed. It is certain, our furniture is much less than when it was a living language, and therefore the greater liberty must of necessity be sometimes taken. So that their opinion seems not unadvisable, who direct us to make choice principally of what we are furnished with from the writers of the Augustan age; and where we cannot be supplied from them, to make use of such authors as lived nearest to them, either before or since. And as to our own tongue, it is certainly prudent to be as careful how we admit any thing into it that is uncouth or disagreeable to its genius, as the ancient Romans were into theirs; for the perfection of a language does in a great measure consist in a certain analogy and harmony running through the whole, by which it may be capable of being brought to a standard.

But besides those things already mentioned, any mistake in the sense of words, or their construction, is opposed to purity. For to speak purely, is to speak correctly. And such is the nature of these faults in elocution, that they are often not so easy to be observed by hearing as by reading. Whence it is, that many persons are thought to speak better than they write; for while they are speaking, many slips and inaccuracies escape disregarded, which in reading would presently appear. And this is more especially the case of persons unacquainted with arts and literature; who, by the assistance of a lively fancy and flow of words, often speak with great ease and freedom, and by that means please the ear; when, at the same time, what they say, would not so well bear reading.

We shall only add, that a distinction ought likewise to be made between a poetic diction and that of prose writers. For poets in all languages have a sort of peculiar dialect, and take greater liberties, not only in their figures, but also in their choice and disposition of words; so that what is a beauty in them would often appear unnatural and affected in prose.

### § 2. *Of Perspicuity.*

43 Perspicuity explained and illustrated.

PERSPICUITY, as well as *purity*, consists partly in *single words*, and partly in their *construction*.

I. As

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44 As to single words.

I. As to *single words*, those are generally clearest and best understood which are used in their pro[illegible] sense. But it requires no small attention and skill [illegible] be well acquainted with the force and propriety of words; which ought to be duly regarded, since the perspicuity of a discourse depends so much upon it. Cæsar seems plainly to have been of this mind, when he tells us, "The foundation of eloquence consists in the choice of words." It may not be amiss, therefore, to lay down some few observations, by which the distinct notions of words and their peculiar force may more easily be perceived. All words may be divided into *proper words* and *tropes*. Those are [illegible] *proper words*, which are expressed in their prope[illegible] sense. And *tropes* are such [illegible] some other thing than what th[illegible] reason of some similitude, relation, or contrariety between the two things. So, when a subtle artful man is called a *fox*, the reason of the name is founded in a similitude of qualities. If we say, *Cicero will always live*, meaning *his works*, the cause is transferred to the effect. And when we are told, *Cæsar conquered the Gauls*, we understand that he did it with the assistance of his army; where a part is put for the whole, from the relation between them. And when Cicero calls Antony *a fine guardian of the state*, every one perceives [illegible] means the contrary. But the nature and use of tropes will be explained more fully hereafter in their proper place. All words must at first have had one original and primary signification, which, strictly speaking, may be called their *proper sense*. But it sometimes happens through length of time, that words lose their original signification, and assume a new one, which then becomes their proper sense. So *hostis* in the Latin tongue at first signified a *stranger*; but afterwards that sense of the word was entirely laid aside, and it was used to denote a *public enemy*. And in our language, it is well known, that the word *knave* anciently signified a *servant*. The reason of the change seems to be much the same, as in that of the Latin word *latro*; which first signified a *soldier*, but afterwards *a robber*. Besides, in all languages it has frequently happened, that many words have gradually varied from their first sense to others somewhat different; which, may, notwithstanding, all of them, when rightly applied, be looked upon as proper. Nay, in process of time, it is often difficult to say which is the original, or most proper sense. Again, sometimes two or more words may appear to have the same signification with each other, and may therefore be used indifferently; unless the beauty of the period, or some other particular reason, determine to the choice of one rather than another. Of this kind are the words *ensis* and *gladius* in the Latin tongue; and in ours, *pity* and *compassion*. And there are other words of so near an affinity to each other, or at least appear so from vulgar use, that they are commonly thought to be synonymous. Such are the words *mercy* and *pity*; though mercy in its strict sense is exercised towards an offender, and pity respects one in distress. As this peculiar force and distinction of words is carefully to be attended to, so it may be known several ways. Thus the proper signification of substantives may be seen by their application to other substantives. As in the instance just now given, a person is said to show *mercy to a criminal*, and *pity to one in distress*. And in the like manner, verbs are distinguished, by being joined to some certain nouns, and not to others. So a person is said *to command an inferior, to intreat a superior*, and *to desire an equal*. Adjectives also, which denote the properties of things, have their signification determined by those subjects to which they most properly relate. Thus we say, *an honest mind*, and *a healthful body; a wise man*, and *a fine house*. Another way of distinguishing the propriety of words, is by their use in gradations. As if one should say, *Hatreds, grudges, quarrels, tumults, seditions, wars, spring from unbridled passions*. The proper sense of words may likewise be [illegible]n by observing to what other words they are ei[illegible] [illegible] used as equivalent. So in that passage [illegible] "I cannot perceive why [illegible] th me: if it be because I de[illegible] why may not I be displeased with you for accusing [illegible] whom I defend? You say, I accuse my enemy; and I say, I defend my friend." Here the words *accuse* and *defend, friend* and *enemy*, are opposed; and *to be angry* and *displeased*, are used as terms equivalent. Lastly, the derivation of words contributes very much to determine their true meaning. Thus because the word *manners* comes from the word *man*, it may properly be applied either to that or any other put for it. And therefore we say, *the manners of men*, and *the manners of the age*, because the word *age* is there used for *the men of the age*. But if we apply the word *manners* to any other animal, it is a trope. By these and such like observations we may perceive the proper sense and peculiar force of words, either by their connection with other words, distinction from them, opposition to them, equivalency with them, or derivation. And by thus fixing their true and genuine signification, we shall easily see when they become tropes. But though words, when taken in their proper signification, generally convey the plainest and clearest sense; yet some are more forcible, sonorous, or beautiful, than others. And by these considerations we must often be determined in our choice of them. So whether we say, *he got*, or *he obtained, the victory*, the sense is the same; but the latter is more full and sonorous. In Latin, *timeo* signifies *I fear; pertimeo* is more full and significant; and *pertimesco* more sonorous than either of the former. The Latin and Greek languages have much the advantage of ours in this respect, by reason of their compositions; by the help of which they can often express that in one word for which we are obliged to put two words, and sometimes more. So *pertimeo* cannot be fully expressed in our language by one word; but we are forced to join one or two particles to the verb, to convey its just idea, and say, *I greatly*, or *very much fear*: and yet even then we scarce seem to reach its full force. As to tropes, though generally speaking they are not to be chosen where plainness and perspicuity of expression is only designed, and proper words may be found; yet through the penury of all languages, the use of them is often made necessary. And some of them, especially metaphors, which are taken from the similitude of things, may, when custom has rendered them familiar, be considered as proper words, and used in their stead. Thus, whether we say, *I see your meaning*, or, *I understand your meaning*, the sense is equally clear, though the

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the latter expression is proper, and the former metaphorical, by which the action of seeing is transferred from the eyes to the mind.

45
As to the construction of sentences.

II. But *perspicuity* arises not only from a choice of *single words*, but likewise from the *construction* of them in sentences. For the meaning of all the words in a sentence, considered by themselves, may be very plain and evident; and yet, by reason of a disorderly placing them, or confusion of the parts, the sense of the whole may be very dark and obscure. Now it is certain that the most natural order is the plainest; that is, when both the words and parts of a sentence are so disposed, as best agrees with their mutual relation and dependence upon each other. And where this is changed, as is usually done, especially in the ancient languages, for the greater beauty and harmony of the periods; yet due regard is had by the best writers to the evidence and perspicuity of the expression.

But to set this subject in a clearer light, on which the perfection of language so much depends, we shall mention some few things which chiefly occasion obscurity; and this either with respect to single words, or their construction.

And first, all ambiguity of expression is one cause of obscurity. This sometimes arises from the different senses in which a word is capable of being taken. So we are told, that upon Cicero's addressing himself to Octavius Cæsar, when he thought himself in danger from his resentment, and reminding him of the many services he had done him, Octavius replied, *He came the last of his friends.* But there was a designed ambiguity in the word *last*, as it might either respect the time of his coming, or the opinion he had of his friendship. And this use of ambiguous words we sometimes meet with, not only in poetry, where the turn and wit of an epigram often rests upon it; but likewise in prose, either for pleasantry or ridicule. Thus Cicero calls Sextus Clodius *the light of the senate*, which is a compliment he pays to several great men, who had distinguished themselves by their public services to their country. But Sextus, who had a contrary character, was a relation of P. Clodius, whose dead body, after he had been killed by Milo, he carried in a tumultuous manner into the senate house, and there burnt it with the senators benches, in order to inflame the populace against Milo. And it is in allusion to that riotous action, that Cicero, using this ambiguous expression, calls him *the light of the senate*. In such instances, therefore, it is a beauty, and not the fault we are cautioning against: as the same thing may be either good or bad, as it is differently applied.—Though even in such designed ambiguities, where one sense is aimed at, it ought to be sufficiently plain, otherwise they lose their intention. And in all serious discourses they ought carefully to be avoided. But obscurity more frequently arises from the ambiguous construction of words, which renders it difficult to determine in what sense they are to be taken. Quintilian gives us this example of it: "A certain man ordered in his will, that his heir should erect for him a statue holding a spear made of gold." A question arises here, of great consequence to the heir from the ambiguity of the expression, whether the words *made of gold* are to be applied to the *statue* or the *spear*; that is, whether it was the design of the testator by this appointment, that the whole statue, or only the spear, should be made of gold. A small note of distinction, differently placed between the parts of this sentence, would clear up the doubt, and determine the sense either way. For if one comma be put after the word *statue*, and another after *spear*, the words *made of gold* must be referred to the statue, as if it had been said, *a statue, made of gold, holding a spear.* But if there be only the first comma placed after *statue*, it will limit the words *made of gold* to the *spear* only; in the same sense as if it had been said, *A statue holding a golden spear.* And either of these ways of expression would in this case [illegible] preferable, for avoiding the ambiguity, according to the intention of the testator. The ancient heathen oracles were generally delivered in such ambiguous terms. Which, without doubt, were so contrived on purpose, that those who gave out the answers might have room left for an evasion. See ORACLE.

Again, obscurity is occasioned either by too short and concise a manner of speaking, or by sentences too long and prolix; either of these extremes have sometimes this bad consequence. We find an instance of the former in Pliny the Elder, where speaking of hellebore, he says, "They forbid it to be given to aged persons and children, and less to women than men." The verb is wanting in the latter part of the sentence, *and less to women than men*: which in such cases being usually supplied from what went before, would here stand thus; *and they forbid it to be given less to women than men.* But this is directly contrary to the sense of the writer, whose meaning is, either that it is ordered to be given in a less quantity to women than men, or not so frequently to women as men. And therefore the word *order* is here to be supplied, which being of a contrary signification to *forbid*, expressed in the former part of the sentence, occasions the obscurity. That long periods are often attended with the same ill effect, must be so obvious to every one's experience, that it would be entirely needless to produce any examples in order to evince the truth of it. And therefore we shall only observe, that the best way of preventing this seems to be by dividing such sentences as exceed a proper length into two or more; which may generally be done without much trouble.

Another cause of obscurity, not inferior to any yet mentioned, is *parenthesis*, when it is either too long or too frequent. This of Cicero, in his oration for Sylla, is longer than we usually find in him: "O immortal gods! (for I must attribute to you what is your own; nor indeed can I claim so much to my own abilities, as to have been able of myself to go through so many, so great, such different affairs, with that expedition, in that boisterous tempest of the state), you inflamed my mind with a desire to save my country." But where any obscurity arises from such sentences, they may frequently be remedied by much the same means as was just now hinted concerning long and prolix periods; that is, by separating the parenthesis from the rest of the sentence, and placing it either before or after. So in this sentence of Cicero, the parenthesis may stand last, in the following manner:—"O immortal gods! you inflamed my mind with a desire to save my country: for I must attribute to you what is your own; nor indeed can I claim so much to

my

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my own abilities, as to have been able of myself to go through so many, so great, such different affairs, with that expedition, in that boisterous tempest of the state." This order of the sentence is very plain, and less involved than the former.

## CHAP. II. *Of Composition.*

46 Composition defined and divided.

COMPOSITION, in the sense it is here used, gives rules for the structure of sentences, with the several members, words, and syllables, of which they consist, in such a manner as may best contribute to the force, beauty, and evidence of the whole.

Composition consists of four parts, which rhetoricians call *period*, *order*, *juncture*, and *number*. The first of these treats of the structure of sentences; the second, of the parts of sentences, which are words and members; and the two last, of the parts of words, which are letters and syllables. For all articulate sounds, and even the most minute parts of language, come under the cognizance of oratory.

### § 1. *Of Period.*

47 Period defined and explained.

IN every sentence or proposition, something is said of something. That of which something is said, logicians call the *subject*, and that which is said of it, the *predicate*: but in grammatical terms, the former is *a noun substantive of the nominative case*, and the latter *a finite verb*, denoting affirmation, and some state of being, acting, or suffering. These two parts may of themselves constitute a sentence: As when we say, *The sun shines*, or *the clock strikes*, the word *sun* and *clock* are the subject in these expressions, *shines* and *strikes* imply each the copula and predicate. Most commonly, however, the noun and the verb are accompanied with other words, which in grammatical construction are said either to be connected with or to depend upon them; but in a logical consideration they denote some property or circumstance relating to them. As in the following sentence: *a good man loves virtue for itself.* The subject of this sentence is *a good man*; and the predicate, or thing affirmed of him, that he *loves virtue for itself*. But the two principal or necessary words, on which all the rest depend, are *man* and *loves*. Now a simple sentence consists of one such noun and verb, with whatever else is joined to either or both of them. And a compound sentence contains two or more of them; and may be divided into so many distinct propositions, as there are such nouns and verbs, either expressed or understood. So in the following sentence, *Compliance gains friends, but truth procures hatred*, there are two members, each of which contains in it an entire proposition. For, *Compliance gains friends* is one complete sentence, and *Truth procures hatred* is another; which are connected into one compound sentence by the particle *but*. Moreover, it frequently happens, that compound sentences are made up of such parts or members, some if not all of which are themselves compounded, and contain in them two or more simple members. Such is that of Sallust: "Ambition has betrayed many persons into deceit; to say one thing, and to mean another; to found friendship and enmity, not upon reason, but interest; and to be more careful to appear honest, than really to be so." This sentence consists of four members; the last of which three, consisting of opposite parts, are all compounded, as will appear by expressing them at length in the following manner; *Ambition has betrayed many persons into deceit*; [that is, ambition] *has betrayed them to say one thing, and to mean another; it has betrayed them to found friendship and enmity, not upon reason, but interest; and it has betrayed them to be more careful to appear honest, than really to be so.* The three last of these members, beginning with the words *it betrays*, are all of them compounded, and consist of two opposite members; which might each of them be expressed at length in the same manner, by supplying the ellipsis. As, *Ambition has betrayed many persons to say one thing, and it has betrayed them to mean another.* And so of the rest. From this instance we see how much is left to be supplied by the mind in all discourse, which if expressed would both destroy its harmony and render it exceedingly tedious. But still regard must be had to that which is omitted, so as to render what is said consistent with it; otherwise there can be no propriety in what is spoken. Nor can the members of a sentence be distinguished and duly ranged in their proper order, without this. But to proceed: Some sentences consist either wholly, or in part, of such members as contain in them two or more compound ones, which may therefore, for distinction's sake, be called *decompound members*.—Of this kind is that of Cicero, in his defence of Milo: "Great is the force of conscience, great either way: that those persons are not afraid who have committed no offence; and those who have offended always think punishment present before their eyes." The latter member of this sentence, which begins with the word *that*, contains in it two compound members, which represent the different state of mind between innocent and guilty persons. And it is in the proper distinction and separation of the members in such complex sentences that the art of pointing chiefly consists. For the principal use of a comma is to divide the simple members, a semicolon the compound ones, a colon such as are decompounded, and a period the whole from the following sentence. We mention this the rather, to show the different acceptation of these terms by grammarians, from that of the ancient writers upon oratory. For these latter apply them to the sense, and not to any points of distinction. A very short member, whether simple or compound, with them is a comma, and a longer a colon; for they have no such term as a semicolon. Besides, they call a very short sentence, whether simple or compound, a *comma*, and one of somewhat a greater length, a *colon*. And therefore if a person expressed himself either of these ways in any considerable number of sentences together, he was said to speak by commas or colons. But a sentence containing more words than will consist with either of these terms, they call a simple period; the least compound period with them requiring the length of two colons. However, this way of denominating sentences, and the parts of them, rather from their length than the nature of them, appearing not so suitable, we have chosen rather to make use of the terms *simple* and *compound members*; and to call all those *compound periods*, which contain two or more members, whether simple or compounded.

But to proceed: Sentences, with respect to their form or composition, are distinguished into two sorts, called

called by Cicero *tracta*, "straight or direct;" and *contorta*, "bent or winding." By the former are meant those whose members follow each other in a direct order, without any inflection; and by the latter, those which strictly speaking are called *periods*. For περιοδος in Greek signifies a *circuit* or *circle*. And so the Latins call it *circuitus* and *ambitus*. By which both of them mean a sentence consisting of correspondent parts, so framed, that the voice in pronouncing them may have a proper elevation and cadency, and distinguish them by its inflection; and as the latter part returns back, and unites with the former, the period, like a circle, surrounds and incloses the whole sense. This elevation of the voice in the former part of the period, is by the Greeks called προτασις, and by the Latins *propositio*; and the depression of it in the latter part, by the one αποδοσις, and by the other *redditio*.

Now as simple sentences have not these correspondent parts, which require any inflection of the voice; nor a circular form, by reason of their brevity; they are not properly periods, in the strict sense of the word: though, in common speech, the words *sentence* and *period* are often used as equivalent terms. Thus, if we say, *Generous minds are incited to the performance of noble exploits from motives of glory;* here is no distinction of parts, nor inflection of the voice in this sentence. And indeed there is not any thing which relates to the structure of these sentences, but what will more properly be taken notice of in the second part of *composition*, which is *order*.

And as to those compound sentences, whose members follow each other in a direct order, without any inflection, there is little art required in their composition. We shall produce one example of this kind from Cicero: "Natural reason inclines men to mutual converse and society; and implants in them a strong affection for those who spring from them; and excites them to form communities, and join in public assemblies; and, for these ends, to endeavour to procure both the necessaries and conveniencies of life; and that not for themselves only, but likewise for their wives, children, and others who are dear to them, and have a right to their assistance." Here are five short members in this sentence, placed in a series, without any inflection of the parts, or orbit of the whole. And as such sentences have no other boundary but the conclusion of the sense, suited to the breath of the speaker, he may either contract or lengthen them at pleasure, without offending the ear. So, should the sentence last mentioned conclude with the first member in this manner, *Natural reason inclines men to mutual converse and society*; the sense would be perfect, and the ear satisfied. The case would be the same at the end of the second member, thus: *Natural reason inclines men to mutual converse and society, and implants in them a strong affection for those who spring from them.* And the like may be said of the rest. Since such sentences therefore may be thus limited at pleasure, it seems more convenient both for the speaker and hearers to confine them to a moderate length.

But because the principal art relating to this part of composition lies in the frame and structure of such compound sentences as are properly called *periods*, we shall treat upon these somewhat more largely. In the formation of these periods, two things are chiefly to be regarded; their *length* and *cadency*. As the length ought to be suited to the breath of the speaker, the ancient rhetoricians scarce admit of more than four colons; by which we may here understand compound members of a moderate size, which will be generally found a suitable and [illegible]. For to extend them farther than the [illegible]age must be painful to the speaker, [illegible] unpleasant to the hearers. As to the cadency, [illegible] Cicero has observed, is found true by experience, that the ears judge what is full and what is deficient; and direct us to fill up our periods, that nothing be wanting of what they expect. When the voice is raised at the beginning of a sentence, they are in suspence till it be finished; and are pleased with a full and just cadency, but are sensible of any defect, and are displeased with redundancy. Therefore care must be taken that periods be neither deficient, and as it were maimed, that is, that they do not drop before their time, and defraud the ears of what seemed to be promised them; nor, on the other hand, offend them by too long and immoderate excursions. This rise and cadency of the voice in pronunciation, depend on the nature and situation of the members, as we shall endeavour to show by particular instances; in the explication of which, by the word *members*, are to be understood such as are uncompounded. In a period of two members, the turn of the voice begins with the latter member. Of this kind is the following sentence of Cicero: "If impudence prevailed as much in the forum and courts of justice, as insolence does in the country and places of less resort; Aulus Cæcina would submit as much to the impudence of Sextus Ebutius in this cause, as he did before to his insolence when assaulted by him." Here the cadency begins at the words *Aulus Cæcina*. If a sentence consist of three members, the inflection is best made at the end of the second member: for if it begin immediately after the first, the voice will be either apt to sink too low, and not to be heard, before it reach the end; or else be precipitated, in order to prevent it. Cicero begins his oration for Milo with a sentence of this form: "Although I fear, it may be a shame to be dismayed at the entrance of my discourse in defence of a most valiant man; and that it nowise becomes me, while Milo is more concerned for the safety of the state than for himself, not to show the same greatness of mind in his behalf: *yet* this new form of prosecution terrifies my eyes, which, whatever way they turn, want the ancient custom of the forum, and former manner of trials." Here the cadency beginning at the third member with the word *yet*, makes a proper division of the sentence, and easy for the speaker. But a period of four members is reckoned the most complete and perfect, where the inflection begins at the middle, that is, with the third member. Nor is it the same case here, as if, in a sentence of three members, the cadency be made at the second. For in proportion to the time of raising the voice may the space be allowed for its sinking. The following sentence of Cicero gives us an instance of this, where he speaks to his son: "Although, son Mark, having now been an hearer of Cratippus for a year, and this at Athens, you ought to abound in the precepts and doctrines of philosophy,

Elocution. philosophy, by reason of the great character both of your instructor and the city; one of which can furnish you with knowledge, and the other with examples: yet, as I always to my advantage joined the Latin tongue with the Greek, and have done it not only in oratory, but likewise in philosophy; I think you ought to do the same, that you may be equally conversant in both languages." The turn in this period begins at the word *yet*; which standing near the middle, the voice is raised to that pitch in pronouncing the former part, as to admit of a gradual cadency, without being lost before the conclusion of the sentence. But where the sense does not suit with this division at the entrance upon the third member, it is best made at the fourth. Such is the following sentence of Cicero: "If I have any genius, which I am sensible is very small; or any readiness in speaking, wherein I do not deny but I have been much conversant; or any skill in oratory, from an acquaintance with the best arts, to which I confess I have been always inclined; *no one* has a better right to demand of me the fruit of all these things than this Aulus Lacinius" The cadency of this sentence does not begin till the words *no one*; yet it ends handsomely, and without disappointing the ear. Though indeed the three first members having each of them an inflection, check the elevation of the voice, and by that variety in the pronunciation add to the harmony of the sentence. An equality of the members should likewise be attended to in the composition of a period, the better to adjust their rise and cadency. And for this reason, in sentences of three members, where the cadency begins with the third; or in those of four members, where it begins at the fourth; it promotes the harmony to make the last member longest. This is properly the nature of rhetorical periods, which when rightly formed have both an equal beauty and dignity in their composition.

But as all discourse is made up of distinct sentences, and whenever we express our thoughts it is in some of the forms above-mentioned; so the use of them is not promiscuous, but suited to answer different designs in speaking. And in this view they are considered and made use of by the orator, as will be shown hereafter.

### § 2. *Of Order.*

48
Order defined and illustrated.

By *order*, rhetoricians mean the placing each word and member of a sentence in such a manner as will most contribute to the force, beauty, or evidence of the whole.

Order is of two kinds, *natural* and *artificial*. And each of these may be considered with respect to the parts either of simple or compound sentences.

As to simple sentences, we may call that order *natural*, when all the words in a sentence are so placed, as they are connected with or follow each other in a grammatical construction. And it may properly enough admit of this name, as it is founded in the nature of a proposition, and the relation of the several words of which it consists to each other. This we explained in the last chapter, and illustrated by proper examples; and shall therefore only give one instance of it here, to introduce the subject we are now upon. And it is this: *The fame of Isocrates excited Aristotle to the profession of oratory*. Here these words, *the fame of Isocrates*, contain the subject of this sentence, with what relates to it; and all those which follow, *excited Aristotle to the profession of oratory*, make up the predicate and its dependants. And in both parts each word grammatically considered stands in its proper order of construction. And this seems agreeable to the natural way of conveying our thoughts, which leads us first to express the subject or thing of which some other thing is said, before the predicate or that which is said concerning it; and with respect to both, as every idea succeeds another in the order of our conceptions, to range it in the same order when we communicate them to others. Our language in the general keeps pretty much to this method. But in one thing particularly it recedes from it; and that is, in placing adjectives, which denote the properties of things, before their substantives or subjects, whose properties they are: As when it is said, *Evil communication corrupts good manners*. And this we always do, except something follows which depends upon the adjective. So we say, *He was a man eminent for his virtue*: not *an eminent man*.

*Artificial* order, as it respects simple sentences, has little or no regard to the natural construction of words; but disposes them in such a manner as will be most agreeable to the ear, and best answer the design of the speaker. The Latins take a much greater liberty in this respect than we do, or than the nature of our language will permit. Quintilian says, it is best for the verb to stand last, when there is no particular reason to the contrary. And he gives this reason for it, *because the force of the sentence lies in the verb*. So that, according to him, they seem to have had this view in putting the verb at the end; that as the whole sentence is imperfect without the verb, the mind being thus held in suspense might receive the deeper impression from it at last. They likewise separate such words as have an immediate relation between them or dependence one upon another, and place any of them first or last as they please. In short, their order seems in a manner arbitrary, if it does not break in upon perspicuity, to which they usually attend. But most of these things are unsuitable to the genius of our language. One might say indeed, *Convince him you cannot*: instead of saying, *You cannot convince him*: Or, *With my own eyes I saw it*; for, *I saw it with my own eyes*. And again: *In proportion to the increase of luxury the Roman state declined*: for, *The Roman state declined in proportion to the increase of luxury*. But this inversion of words is proper in English composition only when it gives force to the expression; as in the higher style it often does. It serves to impress known truths upon the mind, but is unfit for communicating the first principles of knowledge.

As to compound sentences, that is, such as consist of two or more members, either simple or compounded; what relates to the words in each member separately is the same as in simple sentences. But with regard to the disposition of the several members, that may be called the *natural order*, which so places them as they mutually depend on each other. Thus the antecedent member naturally precedes the relative; as in this expression, *Men are apt to forgive themselves what they blame in others*. In hypothetical sentences the

the conditional member naturally stands first. Thus: *If Socrates be a rational creature, he is a man.* That member which expresses the effect of an action naturally comes last; as, *Though you offer ever so good reasons, you will not prevail with him.* The like may be said of time, with regard to things done in it; as, *The Roman eloquence soon declined when Cicero was dead.* And to name no more, the reason of a thing naturally follows that of which it is the reason; as thus: *All the pleasures of life must be uncertain, since life itself is not secure.*

When this order is inverted, it may be styled *artificial.* So to keep to the instances already given, the two members in the first sentence may be thus inverted: *What they blame in others, men are apt to forgive themselves.* In the second, in this manner: *Socrates is a man, if he be a rational creature.* In the third, thus: *You will not prevail with him, though you offer ever so good reasons.* And so in the rest: As, *When Cicero was dead, the Roman eloquence soon declined*; and, *Since life itself is not secure, all the pleasures of life must be uncertain.* The variety of inversions in a sentence may generally be greater or less in proportion to the number of its members. In the following sentence of Cicero, the natural order seems to be this: *If that greatness of mind be void of justice, which shows itself in dangers and labours, it is blameable.* Which may be varied by changing the place of the first and third member, in the following manner: *That greatness of mind is blameable which shows itself in dangers and labours, if it want justice.* Or by altering the place of all the three members thus: *That greatness of mind is blameable, if it be void of justice, which shows itself in dangers and labours.* But oftentimes one member may be included in another, as in the instance here given: *If that greatness of mind, which shows itself in dangers and labours, be void of justice, it is blameable.* Here the relative member is included in the conditional, which is placed first, and the antecedent member follows both. But in Cicero it stands thus: *That greatness of mind, which shows itself in dangers and labours, if it want justice, is blameable*; where the relative and conditional members are both included in the antecedent member. The Latin tongue commonly admits of a much greater variety in the transposition of members, as well as in that of single words, than suits with our idiom. In the following sentence the natural order is much preferable, as it best suits with the proper elevation and cadency of the voice in its pronunciation: *I am willing to remit all that is past, provided it may be done with safety.* But should we invert the members, and say, *Provided it may be done with safety, I am willing to remit all that is past*; the harmony of the cadency would be lost. And if the latter member be included in the former, the alteration will still be worse; as, *I am willing, provided it may be done with safety, to forgive all that is past.* Here the inflection of the voice falls upon the same member as before, and destroys the beauty of the period by its elevation afterwards. Some sentences admit of no involution of their members. Such are those whose members are connected by conjunctive or disjunctive particles. As, *Virtue furnishes the mind with the truest pleasure in prosperity, and affords it the greatest comfort in adversity.* And, *A wise man is neither elated by prosperity, nor depressed by adversity.* And the like may be said of those where the latter member begins with some illative or redditive particle. As in these instances: *The chief thing to be regarded in life is virtue, for all other things are vain and uncertain.* And, *Though fortune is always inconstant, yet she has many votaries.* Neither of the members in any of these ways of expression, and some others which might be named, can be included one in the other. In all the examples hitherto given, the sentences consist only of simple members; and indeed compound members are not so often inverted, nor included one in another, by reason of their length. However, we shall here produce one instance of each: *Whoever considers the uncertainty of human affairs, and how frequently the greatest hopes are frustrated; he will see just reason to be always on his guard, and not place too much dependence upon things so precarious.* This sentence consists of two compound members, which here stand in their natural order, but may be thus inverted: *He will see just reason to be always on his guard, and not place too much dependence on things so precarious; whoever considers the uncertainty of human affairs, and how often the greatest hopes are frustrated.* In the following sentence one compound member is included in another: *Let us not conclude while dangers are at a distance, and do not immediately approach us, that we are secure; unless we use all necessary precaution to prevent them.* Here, the natural order would be: *While dangers are at a distance, and do not immediately approach us; let us not conclude, that we are secure, unless we use all necessary precaution to prevent them.*

But there are some other considerations relating to order, which, being taken from the nature of things, equally suit all languages. So, in amplifying, there should be a constant gradation from a less to a greater; as when Cicero says, *Ambition creates hatred, shyness, discords, seditions, and wars.* On the contrary, in extenuating, we should descend from a greater to a less; as if, speaking of the ancient laws of Rome, one should say, *They were so far from suffering a Roman citizen to be put to death, that they would not allow him to be whipt, or even to be bound.* In constituting any whole, we put the parts first; as, *Invention, disposition, elocution, and pronunciation, make up the art of oratory.* But in separating any whole, the parts follow: as, *The art of oratory may be divided into these four parts; invention, disposition, elocution, and pronunciation.* In every enumeration care must be taken not to mix the whole with the parts; but if it be mentioned at all, it must either be put first or last. So it would be wrong to say, *He was a man of the greatest prudence, virtue, justice, and modesty:* for the word *virtue* here contains in it the other three, and therefore should not be inserted among them. See LANGUAGE, n° 17.

### § 3. *Of Juncture and Number.*

QUINTILIAN, speaking of composition, represents a discourse as very happy in that respect, when the *order*, *juncture*, and *number*, are all just and proper. The first of these, which gives rules for the due placing of the words and members of a sentence, has been already explained. We now proceed to the other two, which relate to letters and syllables; the former treating of their connection, and the latter of their quantity.

I. As

Elocution.

49
The nature and use of juncture explained and illustrated.

I. As to *juncture*. A due attention is to be paid to the nature of the vowels, consonants, and syllables in the connection of words, with regard to the sound.

As to the *first*, when a word ends with a vowel, and the next begins either with a different vowel, or the same repeated, it usually renders the pronunciation hollow and unpleasant. For, as Quintilian has justly observed, "This makes a chasm in the sentence, and stops the course of it." For there must be some pause, in order to pronounce them both, or otherwise the sound of one will be lost. So, for instance, in pronouncing these words, *the other day*, unless you stop a little after the word *the*, the sound of *e* will not be heard; and if it is dropt, it will occasion a rougher sound, from the aspiration of *th* twice repeated so near together, as *th'other day*. Therefore to prevent both these inconveniences, we usually say, *t'other day*. But the different consonants, which together with the vowels make up those syllables, often cause a considerable difference in the pronunciation, so as to render it more or less agreeable. As, if we say, *he overdid it*, the words *he over* have not so harsh a sound as *the other*; though still they require some pause to keep them distinct. Besides, some vowels meet more amicably, and admit of a softer pronunciation, than others. Those which have the weakest and smallest sound, follow best; because they occasion the least alteration of the organ in forming the two sounds. Such are *e* and *i*; and therefore, without any chasm in the sound, or hesitation of the voice, we say *he is*. But where the action of the organs is greater, and the sound stronger, the pronunciation is more difficult: as when we say, *tho' all*. For here is a contrary motion of the lips, which are first put forward in sounding the *o*, and then drawn backward to pronounce the *a*; and therefore the sound is much softer to say, *tho' every*, where their action is less. And the like ill effect commonly happens from the repetition of the same vowel: as if we say, *go on*; or, *usually act thus*. There is a considerable difference between these two expressions, in repeating the sound of the vowel, and where either of them is doubled in a single word. For then the same sound only is protracted by one continued motion of the organ; as in the words *good*, and *deem*. But here the sound is repeated again by a new action of the organ; which, if precipitated, obscures the sound of one of the vowels; and, if too much retarded, makes a chasm in the pronunciation; either of which is unpleasant to the ear.

But as the coalition of two vowels occasions an hollow and obscure sound, so the meeting of some consonants renders it very harsh and rough. Thus the words *king Xerxes*, and *public good*, when so placed have not only a roughness, but likewise a difficulty in their pronunciation, from the contrary action of the lips; which in the former are first drawn back aed then forwards, but in the latter the contrary way, and in both of them with some considerable force. But this may very easily be avoided, by saying, with a little alteration in the words, *Xerxes the king*, and *the good of the public*. So likewise the words *ill company*, have a softer sound than *bad company*, for the same reason. To multiply instances of this kind seems unnecessary, which so frequently occur in all discourses.

The repetition of the same syllable at the end and beginning of words, is the last thing to be considered. And a little observation will convince us, that where this happens, it generally renders the sound either confused or unpleasant. Cicero was often rallied on account of this verse:

*O fortunatam natam me consule Romam.*

Every one will easily perceive a disagreeable sound in the following expression: "A man many times does that unadvisedly, of which he afterwards repents." The chime of the words *man many* both seems affected, and displeases the ear. But this will soon be remedied, if we separate these two words, and say, "A man does that many times unadvisedly."

From the short account here given of this part of composition, it is easy to perceive what things are necessary to render it most complete and accurate; which are these following. If a word end with a vowel, the next ought to begin with a consonant, or such a vowel whose sound may agree well with the former. But if a word conclude with a consonant, either a vowel should follow, or such a consonant whose pronunciation will suit with it. And lastly, the same syllable ought not to be repeated at the end of one word, and the beginning of the next. It has been observed by some critics, that the following verse at the beginning of Virgil's Æneid has all these properties:

*Arma virumque cano, Trojæ qui primus ab oris.*

Where any word in this verse ends with a vowel, the next begins with a consonant; and where any one ends with a consonant, the next begins with a vowel; and there is no repetition of the same sound throughout the whole. But this is what rarely happens, especially in our language, which abounds with consonants. And what Quintilian says of the coalition of vowels, in treating upon this subject, seems applicable to the whole. "This (says he) is a thing not much to be dreaded; and I know not whether the neglect of it, or too great a concern about it, be worse. It necessarily checks the vigour of the mind, and diverts it from matters of greater importance. And therefore, as it shows negligence to permit it, so to be in constant fear of it discovers a low genius." This was the opinion of that judicious writer. And as these things cannot always be attended to, it may be sufficient to avoid them, where they prove very offensive to the ear, and it may be done without some greater inconvenience. So in this sentence, *Honesty is the best policy*, the coalition of *t* and *p* in the two last words *best policy* produces a roughness in their pronunciation; but as the expression is strong, and cannot perhaps be well altered for the better, the sound here ought to give way to the sense.

50
The nature and use of number.

II *Number*. This respects the quantity of syllables, as *Juncture* does their quality. In the Greek and Roman languages every syllable has its distinct quantity; and is either long, short, or common: two or more of which joined together in a certain order make a foot, and a determinate number of these in a different order constitute their several sorts of metre. This variety of sounds gives a much greater harmony to their poetry, than what can arise only from the

Elocution. seat of the accent, and the similitude of sound at the end of two verses, which chiefly regulate our metre. And although their prose was not so confined with regard to the feet, either as to the kind or place of them, as their metrical compositions; yet it had a sort of measure, more especially in the rise and cadency of their periods. This they call *rhetorical number*. And accordingly the ancient writers upon this art acquaint us what feet are best suited to the beginning, middle, or conclusion of a sentence. Such rules are not applicable to our language, which has not that accurate distinction of quantity in its syllables. For we are apt to confound accent with quantity, and pronounce those syllables longest on which we lay the accent, though in their nature they are not so. As in the word *ádmirable*, where none but the first syllable *ad* is pronounced long; though that is only rendered so by position, and the two following are so by nature. And again, in the word *ávarice*, we found the first *a* long for the same reason, and the second short; contrary to the nature of both these vowels. However, we shall offer a few things that may be of some use to modulate our periods and adjust their cadency.

A great number of monosyllables do not stand well together. For as there ought to be a greater distance in the pronunciation between one word and another, than between the syllables of the same word; such pauses, though short, yet, when too frequent, make the sound rough and uneven, and by that means spoil its harmony. And this may seem more necessary to be attended to, because the English language abounds so much with monosyllables. On the contrary, a continuation of many long words makes a sentence move too slow and heavily. And therefore such periods generally run best, which have a proper mixture of words of a different length. Besides, as every word has its accent, which with us stands for quantity, a number either of monosyllables, or long words, coming together, so far abates the harmony, as it lessens the variety.

Again, several words of the same ending do not stand well together, especially where the accent falls upon the same syllable in each of them. For this creates too great a jingle by the similitude of sound; and is apt to displease, from an appearance of affectation. Of this kind is the following sentence: *Nothing is more wélcome, delightsome, or whólesome, than rest to a wearied man.* In such expressions therefore, if the order of the words cannot well be altered, some other word should be substituted in the room of one of them at least, to diversify the sound. So in the example here given, the sound might be varied by saying, *Nothing is more wélcome, pleásant, or whólesome.*

But to add no more, if a sentence end with a monosyllable, it is apt to hurt the cadency, and disappoint the ear; whereas words of a moderate length carry a greater force with them, by the fulness of their sound, and afford the ear what it expected. And there is one sort of monosyllables more especially, which never stand well at the conclusion of a period, though we frequently find them there; and these are the signs of cases. Thus we say, *Avarice is a crime, which wise men are too often guilty óf.* But the cadency would doubtless be more agreeable if it was altered thus: *Avarice is a crime, of which wise men are too often gúilty.* Every one must perceive, when the accent falls upon the last syllable in the sentence, as it does if it end with *óf*, the sound is not so pleasant as when it rests upon the preceding syllable in the word *gúilty*. Nor are very long words well suited either to the beginning or conclusion of a period; for they retard the pronunciation at first, and fall too heavy at the end.

## Chap. III. *Of Dignity.*

51 The necessity of dignity in an oration.

Dignity consists in the right use of tropes and figures. It is not sufficient for an orator to express himself with propriety and clearness, or in smooth and harmonious periods; but his language must likewise be suited to the nature and importance of the subject. And therefore, as *elegance* gives rules for the first of these, and *composition* for the second; so does *dignity* for the last of them. It is very evident, that different subjects require a different style and manner of expression; since, as Quintilian says, "What is magnificent in one discourse would be turgid in another; and those expressions which appear low upon a sublime subject, would suit lesser matters: and as in a florid harangue a mean word is remarkable, and like a blemish; so any thing lofty and bright upon a trivial argument is disproportionate, and like a tumour upon an even surface." Now this variety in the manner of expression arises in a great measure from *tropes* and *figures*, which not only enliven and beautify a discourse, but give it likewise force and grandeur; for which reason this part of elocution seems to have been called *dignity*.

Tropes and figures are distinguished from each other in several respects. Tropes mostly affect single words, but figures whole sentences. A trope conveys two ideas to the mind by means of one word; but a figure throws the sentence into a different form from the common and usual manner of expression. Besides, tropes are chiefly designed to represent our thoughts, but figures our passions.

### § 1. *Tropes.*

52 Tropes, what.

A *trope*, which is a figure of words, has been usually defined to be *the change of a word from its proper signification to some other with advantage, either as to beauty or strength.* The words, *with advantage*, are added in the definition, because a trope ought not to be chosen, unless there is some good reason for using it rather than the proper word. But in what manner, or how far, it can be said of all tropes in general, that they change the proper signification of words, will best appear by considering the nature of each kind of them separately. Now in every trope a reference is had to two things, which occasions two ideas; one of the thing expressed, and another of that thing to which it has a respect, and is supplied by the mind. For all tropes are taken either from things internally related, as the whole and a part; or externally, as cause and effect, subject and adjunct; or from some similitude that is found between them; or from a contrariety. The first of these is called *synedoche*, the second *metonymy*, the

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the third *metaphor*, and the last *irony*. We shall endeavour to illustrate this by examples. When we say, *Hannibal beat the Romans*; the meaning is, that Hannibal and his army did this. So that although in some sense a part may here be said to stand for the whole, which makes it a *synecdoche*; yet, strictly speaking, the word *Hannibal* does not alter its sense, but there is an ellipsis in the expression, Hannibal being put for himself and his army. But if we say, *Cicero should be read by all lovers of eloquence*; here indeed the word *Cicero* appears to be changed from its proper sense, and to signify the books of Cicero; which is a *metonymy*, the author being put for his works; and therefore such expressions need not be deemed elliptical. Again, if any one, speaking of a subtle and crafty man, should say *he is a fox*; the meaning is, he is like a fox; which is a *metaphor*; where the word *fox* retains its proper sense, and denotes that animal, to which the man is compared on account of his craft. Lastly, if a person say to another, *Well done*; meaning that the thing was ill done, the word *well* keeps its own sense; but from the manner of its pronunciation, or some other circumstance attending the expression, it will be evident that the contrary is intended; which is called an *irony*. From these instances it may appear in what latitude we must understand the common definition of a trope, which makes it to consist in the change of a word from its proper sense into some other. But though in reality there are but four kinds of tropes, which are distinguished by so many different respects which things bear one to another; yet as these several respects are found in a variety of subjects, and attended with different circumstances, the names of *tropes* have from hence been greatly multiplied; which, however, may all be referred to some or other of those already mentioned, as will be shown when we come to treat of them in their order. And for distinction sake we shall call the former *primary*, and the latter *secondary*, *tropes*.

We now proceed to consider the reasons which have occasioned the introduction of tropes. And these, as Quintilian observes, are three; *necessity*, *emphasis*, and *beauty*.

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1. Tropes were first introduced from *necessity*, deriving their origin unquestionably in a considerable degree from the barrenness of language, because no language which we know contains a sufficient number of proper words to express all the different conceptions of our minds: but the principal cause of their introduction seems to be that extensive influence which imagination possesses over every kind of speech. The mind considers the same thing various ways; views it in different lights; compares it with other things; and observes their several relations and affections; wherein they agree, and in what they differ. From all which reflections it is furnished with almost an infinite number of ideas; which cannot all of them be distinguished and expressed by proper words, since new ones occur daily. And were this possible, yet would it be impracticable, because the multitude of words must be so vastly great that the memory could not retain them, nor be able to recal them as occasion required. Tropes have in a good measure redressed both these inconveniences; for by means of them the mind is not burdened with a numberless stock of different words, and yet nothing seems to want a name. Thus sometimes where a word is wanting to express any particular thing, it is clearly enough represented by the name of some other thing, by reason of the similitude between them. At other times, the cause is signified by the effect, the subject by the adjunct; or the contrary. And the whole is often understood by a part, or a part by the whole. And thus by the use of tropes the mind is helped to conceive of something not expressed, from that which is expressed. It is much the same case, as when we have occasion to speak of a person, whose name we are either unacquainted with, or have forgot; for by describing his person, abode, or some other circumstances relating to him, those we converse with as well understand whom we mean, as if we mentioned his name. So the shepherd in Virgil, when he could not think of the name of Archimedes, describes him by his works:

> And what's his name who form'd the sphere,
> And show'd the seasons of the sliding year?

Besides, it sometimes happens in a discourse, that those things are necessary to be said, which, if expressed in their proper terms, would be offensive; but being clothed with metaphors, may be conveyed to the mind with decency. Thus then the imagination never contemplates any one idea single and alone, but always along with other ideas, which may be called its *accessories*, and which often operate more forcibly upon the mind than the principal idea itself does. In their nature they are often more agreeable, and frequently also more familiar, to our conceptions; or perhaps they remind us of a greater variety of important circumstances. Hence the name of the accessory is often preferred, as, *e. g.* when we want to point out the time in which a state enjoyed its chief reputation, &c. the proper words might do, but the imagination suggests the flourishing period of a plant or tree; and we say "the Roman empire flourished most under Augustus:" Catiline, we say, was the *head* instead of the *leader* of his party, because the head is the principal part of the human figure.

2. A second reason above mentioned for the use of tropes was *emphasis*. Tropes do many times express things with greater force and evidence than can be done by proper words. We receive much the greater part of our knowledge by our senses. And similitudes taken from sensible things, as in metaphors, very much assist the mind in its reflections upon those things which do not come under the cognizance of the senses. For it is certain, that we are sooner and more strongly affected with sensible objects, than with things of which we can have no ideas but from the internal operations of our own minds. Nay, sometimes one bright and lively trope shall convey a fuller and more just idea of a thing than a large pariphrasis. So when Virgil calls the Scipios *two thunderbolts of war*, he gives a more lively image of the rapid force and speedy success of their arms, than could have been conveyed by a long description in plain words. And in many cases the tropical use of words is so emphatical, and suited to the idea we design to excite, that in this respect it may

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may be justly esteemed the most proper. So, *incensed with anger, inflamed with desire, fallen into an error*, are all metaphorical expressions, used in a way of similitude; and yet perhaps no proper words can be made use of, which will convey a more lively image of the thing we design to represent by them.

But *beauty* and ornament, as was observed before, have been another cause of the use of tropes. Some subjects require a more florid and elegant dress than others. When we describe or applaud, ornaments of speech and a gaiety of expression are requisite. And it is the business of an orator to entertain his hearers at the same time that he instructs them. Now Cicero, who was an admirable judge of the force and power of eloquence, has observed, that tropical expressions give the mind the greatest delight and entertainment. "I have often wondered (says he) why tropes should give greater pleasure than proper words. I imagine the reason must be, either that there is an appearance of wit in neglecting what is at hand, and making choice of something at a distance; or that the hearer is furnished with a different thought, without being led into a mistake, which affords a very agreeable pleasure: or that a whole similitude is conveyed to the mind by a single word; or that, particularly in the best and most lively metaphor, the image is presented to our sight, which is the quickest of our senses." And therefore he supposes, that "as garments were first invented from necessity, to secure us from the injuries of the weather, but improved afterwards for ornament and distinction; so the poverty of language first introduced tropes, which were afterwards increased for delight." Besides, a variety of expression is pleasing in a discourse. It is many times necessary that the same thing should be repeated; and if this be done in the same words, it will grow tiresome to the hearers, and sink their esteem of the speaker's ability. Therefore, to prevent this, it is proper the expression should be varied, that although the sense be the same, it may give the mind a new pleasure by its different dress.

We come now, in the last place, to lay down some directions proper to be observed in the choice of tropes.

And first, as every trope gives us two ideas; one, of the word expressed; and another, which, by means of that, the mind connects with it; it is necessary, that the relation between these two appear very plain and evident. For an obscure trope is always faulty, unless where some particular reason makes it necessary. And therefore tropes ought not to be too far-fetched, lest that should render them dark. For which reason Cicero says, he should not choose to call any thing destructive to a person's fortune, *the Syrtis of his patrimony*, but rather the *rock of it*; nor the *Charibdis of his estate*, but the *gulph of it*. For those who either did not know that the Syrtes were two quicksands upon the coast of Africa, or that Charibdis was a gulph in the strait of Sicily, both of them very destructive to mariners, would be at a loss to understand the meaning of the metaphor. Besides, metaphors taken from things we have seen, affect the mind more forcibly than those which are taken from such things as we have only heard of. Now there is scarce any one who has not seen a rock or a gulph; but there are very few persons, comparatively, who have been either at Charibdis or the Syrtes." It is necessary therefore in a good trope, not only that there be a near affinity between the two ideas, but likewise that this affinity be very obvious and generally known, so that the word be no sooner pronounced but both images do immediately present themselves to the mind.



Again, as a trope ought to be very plain and evident, so likewise should it bear a due proportion to the thing it is designed to represent, so as neither to heighten nor diminish the just idea of it. Indeed, sometimes when we speak of things indefinitely, we say too much, lest we should seem to say too little. And this manner of speaking is called an *hyperbole*; which is not uncommon in the sacred writings. So, for instance, Saul and Jonathan are said to be *swifter than eagles, and stronger than lions*. But even in this way of expression a proportion is to be observed. For some very considerable and unusual excess of the thing in its kind is at least designed by it; which, perhaps, cannot, or however is not necessary to be defined. And therefore Quintilian blames Cato for calling the top of an hill a *wart*; because the proportion between the two ideas is nowise adequate. And so on the contrary Aristotle censures Euripides for calling rowing *the empire of the oar*. Poets indeed are allowed a greater liberty in this respect; but an orator should be modest in his expressions, and take care that he neither so heighten nor diminish the natural ideas of things by tropes, a to lead his hearers into mistakes.

But further: as a moderate use of tropes, justly applied, beautifies and enlivens a discourse; so an excess of them causes obscurity, by running it into abstruse allegories and riddles. Tropes are not the common and ordinary dress of our thoughts, but a foreign habit: and therefore he who fills his discourse with a continued series of them, seems to act like one who appears in public in a strange dress: which no man of character would choose to do.

Moreover, as one use of tropes is pleasure and entertainment, we should endeavour to make choice of such as are smooth and easy. But if at any time we think it necessary to use a harsh trope, it is proper to soften it by some precaution. For, as Cicero very handsomely says, *a trope should be modest, since it stands in a place which does not belong to it; for which reason it should seem to come thither by permission, and not by force*. And therefore when he thought it harsh to say, *The death of Cato made the senate an orphan*; he guards the expression by saying, *The death of Cato has (if I may be allowed to say so) rendered the senate an orphan*.

And, to add no more, care should be taken how we transfer tropes from one language into another. For as they are frequently taken not only from natural things, or such notions as are common to the generality of mankind, but likewise from the manners, customs, and occurrences of particular nations; so they may be very plain and obvious to those among whom they took their rise, but altogether unintelligible to others who are unacquainted with the reason of them. It was customary for the Roman soldiers to carry their money in their girdles: hence it was the same thing with them to say, *a person had lost his girdle*, as that *he had lost his money*. And because the Romans wore the *toga*, which was a long gown, in time of peace, and a different garb when engaged in war, their writers

 ters sometimes use the word *toga* to signify peace. But as neither of these customs is in use among us, so neither would the tropes suit our language, or be generally understood by us. And even in such tropes as are taken from the common nature of things, languages very much differ. There is a very beautiful trope in the account of St Paul's shipwreck, where it is said, *The ship was caught, and could not bear up into the wind.* The original word, that we translate *bear up*, is ἀντοφθαλμεῖν; and properly signifies, *to look or keep its eyes against it;* which is a very strong and lively image, taken from animate beings, and when applied to men, often signifies *to withstand* or *resist:* ἀντοφθαλμεῖν πολεμίῳ, *to resist an enemy;* and Plutarch says of Demosthenes, that he could not ἀντοφθαλμεῖν τῷ ἀργυρίῳ, *look against* or *resist the power of money.* Nothing is more common with Latin writers, than to call men of a public spirit and true patriots, *lumina et ornamenta reipublicæ*, that is, *the lights and ornaments of the state.* And we have borrowed from them the use of both these metaphors. But because tropes and figures illustrate and heighten the style, they call them also, *lumina orationis*, or *the lights of a discourse.* It sometimes happens, that only the tropical sense of a word is taken from one language into another, and not the proper signification of the same word. So *scrupulus* in Latin properly signifies *a little stone, which getting into the shoe hurts a person as he walks;* hence it is applied to the mind, and used to express *a doubt, or uneasy thought that gives it pain.* We have borrowed this latter sense of the word, but not the former.

### Art. I. Primary Tropes.

54 Metaphor, what. I. *Metaphor.* A metaphor, as usually defined, is, *A trope, which changes words from their proper signification to another different from it, by reason of some similitude between them.* But that a word, when used metaphorically, does not alter its signification, but retains its proper sense, was shown above. However, it may not be amiss to explain this matter more fully, and set it in a clearer light. Every *metaphor*, then, is nothing else but a short similitude. Cicero calls it *a similitude reduced to a single word.* And Quintilian to the same purpose says, that "a metaphor is a short similitude, and differs from it only in this, that the former is compared to the thing we design to express, and the latter is put for it. It is a similitude, when I say of a man, he has acted like a lion; and a metaphor, when I say, he is a lion." Thus far Quintilian. Now in every similitude three things are requisite; two things that are compared together, and a third in which the similitude or likeness between them consists. And therefore, to keep to this example, when Horace calls a Roman soldier *a lion*, if the word *lion* did not retain its proper sense, there could be no similitude; because there would not be two things to be compared together with respect to a third, which is necessary in every similitude, and was designed by this expression. The sense of which is plainly this: *That as a lion seizes his prey with the greatest fierceness, so a Roman soldier with like rage and fury attacked his enemies.* In the same manner, when Cicero calls Piso *the vulture of the province*, his meaning is, that he was like a vulture, or acted in such a manner as a vulture acts, that is, rapaciously. So that the real difference between a metaphor and a similitude consists in this; that a metaphor has not those signs of comparison which are expressed in a similitude. But some persons have run into mistakes in reasoning from tropes of this kind. For they have so argued from metaphorical words, as if all the affections and properties of the things expressed by them might be attributed to those other things to which they are applied, and by that means have strained the comparison (which has usually but one particular view), in order to make it tally in other respects, where there is not that similitude of ideas. We will endeavour to make this evident by another example from Cicero, where he calls M. Antony *the torch of the state.* The similitude between Antony and a torch lay in this: *That as a torch burns and destroys every thing within its reach, so Antony brought devastation and ruin wherever he came.* Now a torch has not only a property to burn, but also to give light; but the similitude would not hold in this respect, nor was it at all designed. For Cicero never calls a wicked profligate man, as Antony was, *the light of the state;* though he often gives that character to good and virtuous men, who by their examples do as it were enlighten others, and show them the way to be happy themselves and useful to others. But though metaphors are usually taken from a similitude between two things, as in the instances here mentioned; yet sometimes they are founded in the similitude which two things bear to two others in some particular respect, by means whereof what properly belongs to one of them is transferred to the other: the former of which are called *simple metaphors*, and the latter *analogous.* Hence the rudder of a ship may be called its *reins;* for what the reins are to a horse, that the rudder is to a ship in guiding and directing it. So that here is a double similitude, one between a ship and an horse, and another between the rudder of the former and the reins of the latter; and from the analogy between the use of the rudder to the one and reins to the other, the reins, which belong properly to the horse, are applied to the ship. Again, some metaphors are reciprocal, in which the similitude holds either way. Thus to steer and to govern are used reciprocally both of a ship and a state: the proper expressions being, *to steer a ship, and govern a state;* and the contrary metaphorical. But though we say, *the foot of a mountain*, borrowing the similitude from animals; yet we do not say, on the contrary, *the bottom of an animal*, meaning his feet; and therefore that metaphor is not reciprocal. From this account therefore of the nature of a metaphor, it may be said to be, *The application of a word by way of similitude to some other thing than what it properly signifies.* And the plainer this similitude appears, the greater beauty there is in the trope.

The use of metaphors is very extensive, as large as universal nature. For there are scarce any two things which have not some similitude between them. However, they may all be reduced to four kinds; which was the second thing proposed to be considered.

The first kind of metaphors therefore may be taken from similitudes between animate beings. As where those things, which properly relate to brutes, are accommodated to men; or those which belong to men are applied to brutes. Of the former sort is that joke of Cicero: *My brother being asked by Philip, why he barked*

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A second kind of metaphors lies between inanimate things, whether natural or artificial, which bear some similitude to each other. And this head is very extensive. Thus we say, *floods of fire*, and *clouds of smoke*, for large quantities. And so likewise, *to inflame an account*, that is, to heighten or increase it; with innumerable others of the like sort. In the two first of these instances, the terms proper to one element are applied to another; and as those elements of fire and water are opposite to each other, they show the extensiveness of this trope, that there are no things in nature so contrary, but may come within the limits of it, and be accommodated to each other in a way of similitude. In the last example, a natural action is applied to what is artificial.

A third sort of metaphors is, when inanimate things are applied to animals, on account of some like properties between them. Thus Homer calls Ajax, *the bulwark of the Greeks*, on account of his valour, which like a wall defended them from the Trojans. And [illegible] [illegible] for his great discernment and quick perception of things; fetching the allusion from metals when brought to an edge or a point. As, on the contrary, old Chremes in Terence calls himself a *stone*, for want of apprehension. And we say, *a gay person*, and *a bright genius*, by this kind of metaphor.

The fourth and last kind of metaphors is that by which the actions and other attributes of animals are accommodated to inanimate things. Thus Cicero, speaking of Clodius, says: "The very altars, when they saw that monster fall, seemed to move themselves and assert their right against him." Here the words *saw*, *move*, and *assert*, are all metaphors taken from the properties of animals. And Virgil, when he would represent the impetuous force and rapidity of the river Araxes, says, *it disdained a bridge*. And it is a very usual epithet, which Homer gives to words, to call them *wheeling*, or *winged*, to intimate the swiftness of speech.

Lastly, as to the choice of metaphors, those are esteemed the finest and strongest, which *give life and action to inanimate things*. The reason of which is, because they do as it were invigorate all nature, introduce new forms of beings, and represent their images to the sight, which of all the senses is the quickest, most active, and yet most unwearied. What can be more moving, or in stronger terms express the villany of Clodius, than when Cicero says, "The very altars of the gods seemed to exult at his death." And the same great orator particularly commends those metaphors, for their sprightliness and vivacity, which are taken from the sense of seeing; as when we say *a bright thought*, or *a gay expression*.

However, care must be taken not to venture upon too bold and daring metaphors. Poets indeed claim greater liberty in this respect, whose view is often to amuse, terrify, or delight, by heightening the just and natural images of things. But it is expected the orator should reason coolly, though strongly and forcibly; and not by theatrical representations so transport the mind, as to take it off from reflection, unless perhaps on some particular occasion. And yet, on the other hand, metaphors ought not to sink below the dignity of what they are designed to express; but the idea they convey should at least be equal to the proper word in the place of which they are substituted.

But there is a very great difference in the choice of metaphors, as they are designed either to praise or dispraise. One thing may be compared to another in a great variety of respects. And the same thing may be made to appear either noble or base, virtuous or vicious, by considering it in a different light. Such metaphors, therefore, as are chosen to commend, must be taken from great and laudable things; and on the contrary, those which are designed to discommend, from things vile and contemptible. Aristotle gives us a very pleasant example of this in the poet Simonides. A certain person, who had carried the prize at a race of mules, offered him a reward to write a poem in honour of that action. Simonides thought he did not bid high enough; and therefore put him off with say- [illegible] and, as Aristotle observes, when he has occasion to speak of the mules in that poem, he does not mention them by that name, but calls them *the daughters of fleet and generous horses*, though he might with as much propriety have called them *the daughters of dull asses*. But it was the poet's business, in praising, to take the most advantageous part of the character. Where things are capable of such different turns, metaphorical expressions are generally most beautiful. And sometimes the same metaphor may be applied contrary ways, both in praise and dispraise, as it will suit different properties of the thing to which it refers. So a *dove*, in a metaphorical sense, may represent either *innocence* or *fear*; and an *iron heart* may denote either *courage* or *cruelty*; as an *hard head*, *strength* or *weakness of thought*. And this ambiguity in the application of metaphorical words often affords occasion for jests

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jests and concise wit. We observed before, that Cicero never calls ill men, *lights of the state*. But he once in this manner calls Sextius Clodius *the light of the senate*. For when his kinsman Publius Clodius had been killed by Milo, and his corpse was brought to Rome, Sextius raised the mob, and in a tumultuous manner carried it into the senate-house, where they burnt it, and by that means set the building on fire: For which seditious act Cicero passes that joke upon him, under the metaphor of light, which elsewhere he always uses in a good sense.

But to proceed: All forced and harsh metaphors should be avoided; the one being no less disagreeable to the mind than the other to the ear. Nor should they come too thick in a discourse. In a word, they ought not to be used, but either where a proper word is wanting, or they are more significant or beautiful than the proper word.

55. Metonymy defined and explained.

II. *Metonymy*. This, as defined by Quintilian, is, *the putting one word for another*. But Vossius describes it more fully, when he calls it, "A trope, which changes the name of things that are naturally united, but in such a manner as that the one is not of the essence of the other." That a metonymy is thus distinguished from the other tropes, has been sufficiently shown already in the two last chapters. When it is said, *to put one word for another*, or, *to change the names of things*, the meaning is, that the word so used changes its sense, and denotes something different from its proper signification. Thus, when *Mars* is put for *war*, and *Ceres* for *corn*, they lose their personal sense, and stand for the effects of which those deities were said to be the cause. So likewise, when Virgil says,

He drank the frothing bowl,

the word *bowl* must necessarily signify the liquor in the bowl. And when in another place, describing the temple of Juno at Carthage, in which the actions of the Trojan war were represented, and the images of the heroes, he makes Æneas, upon discovering that of Priam among the rest, cry out,

Lo here is Priam;

it is plain the word *Priam* there must stand not for his person, but his *image* or *figure*. And this property of changing the sense of the word appears peculiar to metonymy. In treating upon a metaphor, we observed the mistake of those who teach, that a word used metaphorically loses its proper signification; whereas it only changes its place, but not its sense; being applied to a thing to which it does not naturally belong, by way of similitude. And as the not attending to this has run some persons into very great absurdities, in treating upon metaphorical expressions, and reasoning from them in the tropical sense; so the like has happened to others in some instances of a metonymy, where, by misapprehending their true nature, they have reasoned from them in the literal sense, as we shall show presently. A metonymy is not so extensive as a metaphor, nor altogether so necessary: because nothing is said by a metonymy, which cannot be expressed in proper words; whereas metaphors are often used for want of proper words to express some ideas. However, metonymies are very useful in language; for they enrich a discourse with an agreeable variety, and give both force and beauty to an expression. And what we observed with relation to a metaphor, is true also of this trope: that some metonymies, even in common discourse, are more frequently made use of than the proper words in whose room they are put. So, *pale death*, *a blind way*, and *a happy state*, are very common expressions with us. And it is more usual to say, *This is such a person's hand*, or *I know his hand*, than his writing, when we intend this latter sense of the word.

We now proceed to the division of metonymies; which are commonly distinguished into four kinds, from the different manner in which things are naturally, but externally, united to one another. Now things are thus united, or one thing depends upon another, either with respect to its production, or in the manner of its existence when produced. In the former way the effect depends upon its cause, and in the latter the adjunct upon its subjects. And hence arise four sorts of metonymies, which receive their names from the *cause* and *effect*, the *subject* and the *adjunct*.

It is called a *metonymy* of the *cause*, when the external cause is put for the effect. The external cause is twofold, the agent and end, which are usually called the *efficient* and *final cause*. Of the former kind are such metonymies, where the inventor or author is put for what was invented or effected by him. Thus, as we said before, *Ceres* is sometimes put for *corn*, the use of which she was said first to have introduced; and *Mars* for *war*, over which he was thought to preside. And by this way of speaking, any artist or writer is put for his work. So Juvenal, blaming the luxury and profuseness of the Romans, says, *There are few tables without Mentor*; that is, which were not made by him, or after his manner. And our Saviour says, in the parable of the rich man and Lazarus, *They have Moses and the prophets*, meaning the books of Moses and the prophets. But under this sort of metonymy is included not only the agent, strictly so called, but also any means or instruments made use of in the doing of a thing, when put for the thing done. Thus, *polite literature* is called *humanity*, because it cultivates and improves the human mind. And in that expression of Cicero, *Words move nobody but him who understands the tongue*; the word *tongue*, which is the instrument of speech, is put for *speech* or *language*. And in the like sense, *arms* are sometimes put for *war*, and the *sword* for *slaughter*. By the same kind of metonymy likewise any affection or quality is put for its effect. As when it is said, *the end of government is to maintain justice*; that is, *such mutual offices among men as are the effects of justice*. And so likewise in that of Cicero, *It is the business of magistrates to check the levity of the multitude*, by which he means tumults occasioned by their levity. Moreover, as human affections are attributed to the Deity in a metaphorical sense, so several parts of the human body are likewise ascribed to him by this kind of metonymy. Thus, his *hand* and his *arm* are used to express his power, as his *ear* and *eye*, his *care* and *providence*, these being the instruments of such effects in mankind. Metonymies of the final cause are those by which the end in doing a thing is put for the thing done. As when we say, *The watch is set*, meaning the *watchmen*, who are appointed for that purpose. And so likewise that

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that expression, *to make an example*, as it signifies, *to punish*, in order to deter others from the like crimes by such an example. As also that of Virgil,

Phillis should garlands crop:

by which are meant *flowers* to make garlands.

The second kind of metonymy puts the effect for the efficient cause, whether the agent, or only the means and instrument. So Virgil calls the two Scipios *the destruction of Libya*, because they were the agents who effected it. And Horace compliments his patron Mæcenas with the titles of being *his guard and honour;* that is, his guardian, and the author of his honour. But when Cicero tells the citizens of Rome, that *the death of Clodius was their safety*, he means the occasion only of their safety. And elsewhere he calls that a *dark hope* and *blind expectation*, the effect of which was dubious and uncertain to those who entertained it. And in like manner, the sons of the prophets, when they were eating the pottage which Elisha had ordered to be set before them, cried out, *There is death in the pot*; that is, some *deadly thing*, as is presently after explained. And thus sweat, which is the effect of labour, is sometimes put for labour. As in the threat denounced against Adam, *In the sweat of thy face shalt thou eat bread*, that is, by labour in cultivating the ground. And, in allusion to this way of speaking, Antony the orator tells Crassus, "the improvement of the style by constant exercise, as he prescribed, was a thing of much sweat." And *virtue is said to be gained by sweat*, that is, continued care and exercise in subduing the passions, and bringing them to a proper regulation. But in these two expressions there is likewise a metaphor, the effect of bodily labour being applied to that of the mind. In all these instances, the effect is put for the efficient cause.

The third kind of metonymy is, when the subject is put for the adjunct. By subject here, in a large sense of the word, may be understood that wherein some other thing is contained, or about which it is conversant; as likewise the possessor with respect to the thing he possesses; and the thing signified, when put for the sign of it. Now, by the first of these ways of speaking, the seat of any faculty or affection is used for the faculty or affection itself. So it is usual to say, *a man of a clear head*, when we mean a clear mind or understanding; the seat of the mind being supposed to be in the head. And a person is said *to have a warm heart*, because the heart has been thought the seat of the affections. In like manner, the place where any actions are performed is put for the actions done in it. As when Cicero says, "Do not always think of the forum, the benches, the rostra, and the senate;" meaning the discourses which were usually made in those places. So likewise the country, or place of residence, is put for the inhabitants, as in that passage of Cice-... "And to omit Greece, which always claimed the pre-eminence for eloquence, and Athens, the inventress of all sciences, where the art of speaking was invented and perfected; in this city of ours, (meaning Rome), no studies have prevailed more than that of eloquence:" where the words Greece and Athens stand to denote the inhabitants of those places. And hither may also be referred those expressions in which the time is put for the persons living in it; as, *the degeneracy of the present age, the virtue of former times*. In the second way above-mentioned, the object is used for the person or thing employed about it: As when Cicero says, "In time of battle the laws are silent; where by *laws* he intends the *judges*, who pronounce sentence according to law. By the third of these ways, in which the possessor is put for the thing he possesses, we say, *to devour, destroy*, or *ruin a man*, meaning not his *person* but his *estate*. And mythologists explain the fable of Actæon by this trope, who is said to have been devoured by his dogs; for by dogs they understand flatterers and parasites, who consumed his estate, and brought him to beggary. By the last way before recited, which puts the thing signified for the sign, statues and pictures are called by the names of the persons which they represent: as in that jest of Cicero upon his brother Quintus, when, as Macrobius relates, "being in the province which his brother had governed, and seeing a large portrait of part of his body, holding a shield, though Quintus was but a little man, he said, My half brother is bigger than my whole brother." The Popish doctrine of transubstantiation is founded upon an abuse of this trope. For when our Saviour, speaking of the bread and wine at that time before him, says, "This is my body, and this is my blood," his plain meaning is, they were the signs of his body and blood, the thing signified being put for the sign by this sort of metonymy. But the Papists take the expression literally, which must doubtless be very absurd: since the words relate to the time then present, while Christ was yet living, and spoke them; when it was impossible for the bread and wine to be converted into his body and blood, it being evident to all who were present, that those elements, and his body, existed separately at the same time. But if the words are explained by this trope, the sense is plain and easy, and the way of speaking familiar to all writers. Whereas they who plead for the literal sense might with equal reason assert that those expressions above-mentioned are to be taken literally, in which several parts of the human body, as the hand, the arm, the ear, and the eye, are ascribed to the Deity; or that, when our Saviour in a metaphorical sense calls himself *a vine*, and *a door*, these words were designed to be applied to him strictly and properly, and not by way of similitude only, as is the case in all metaphors.

The fourth kind of metonymy is that wherein the adjunct is put for the subject, which is done in the same variety of ways as the former. It is therefore a metonymy of the adjunct, when the thing contained is put for that which contains it. As when Virgil says, "They lie down upon purple;" that is, upon couches dyed with purple And again, "They crown the wine;" meaning the bowl which contained the wine, it being the custom of the ancients to deck their bowls with garlands at their entertainments. By these tropes likewise virtues and vices are put for the persons in whom they are found. As in that beautiful passage of Cicero, where, comparing the profligate army of Catiline with the forces of the state, he says, "On this side modesty is engaged, on that impudence; on this chastity, on that lewdness; on this integrity, on that deceit; on this piety, on that profaneness; on this constancy, on that fury; on this honour, on that baseness; on this moderation, on that unbridled passion;

in a word, equity, temperance, fortitude, prudence, and all virtues, engage with injustice, luxury, cowardice, rashness, and all vices." And to this trope those expressions are to be referred, in which any thing is put for the object about which it is conversant. As in that saying of the wise man, "Hope deferred makes the heart sick;" where hope is put for the thing hoped for. And thus Suetonius calls the emperor Titus *the love and delight of mankind*, whose mild and obliging temper rendered him the object of those agreeable affections to all persons under his government. A third use of this trope is by putting a thing for the time in which it was done. Thus we say of a person, *he has served so many campaigns*, meaning so many summers, that being the usual time in which armies are drawn out into the field. Lastly, by this metonymy, the sign is put for the thing it signifies; as, *the sceptre* for *the regal dignity*, and *the sword* for *the authority of the magistrate*.

56 Synecdoche explained.

III. *Synecdoche.* This is a trope by which either the whole of a thing is put for a part of it, or a part for the whole; so that the two things, whose ideas are presented to the mind in this trope, are internally related to each other; by which, as has been shown already, it is distinguished from all the other tropes. In a *synecdoche* the word retains its proper sense, and the expression is elliptical, as will appear by the several species of it, wherein the ellipsis in most of the examples is very obvious, and may with no great difficulty be supplied. Now a thing may be considered as a whole in three different respects, which logicians call an *universal, essential, and integral whole*. An universal whole is any genus with regard to its several species: as, an *animal* with respect to *mankind* and *brutes*, or *philosophy* with respect to the several *arts* and *sciences* comprised under it. An essential whole consists of matter and form, as, a *man* of *body* and *soul*. And an integral whole is any body or quantity, with respect to the several parts of which the matter of it is composed, and into which it may be divided: as, an *human body* with respect to its *several members*; or a *year*, as divisible into *months*, *weeks*, and *days*. And thus rhetoric is an integral whole in respect to the four parts that compose it; namely, invention, disposition, elocution, and pronunciation. So likewise any aggregate body, as a civil community, which is divisible into those who govern and are governed; or any army, consisting of the general and his soldiers. As a whole therefore, in each of these acceptations of the word, is frequently put for a part, and a part for the whole; hence arise six species or sorts of synecdoche.

The first of these puts the genus for the species.—Thus, virtue in general is sometimes used to denote some particular sort of virtue. As when Cicero mentions virtue as one of the four qualifications necessary in a general, he means greatness of mind. And so persons are often commended for instances of virtue shown in their conduct, which respect only some single virtue, as justice, temperance, or the like: And in this sense Cicero calls Clodius *a deadly animal*. So when our Saviour commissions his apostles to *preach the gospel to every creature*, the meaning is, *every rational creature*. And thus likewise, *to talk to a person* sometimes denotes the same thing as to *blame* him, which is one way of talking.

The second kind of synecdoche puts the species for the genus. Thus *bread* denotes any kind of food; as when a person is said *to get his bread by his labour*. In the same way of speaking, *money* is put for any kind of wealth in general. And it is an usual expression to say, that *wine destroys more than the sword*; that is, than any *hostile arms*. And the legal form of banishment among the Romans was, to prohibit persons *the use of fire and water*; that is, *the most common and ordinary necessaries of life*, in which all others were included.

The third species of this trope is, when the essential whole is put for one of its parts; that is, either for the matter or form. Thus, in the evangelist, Mary Magdalen says, *They have taken away my Lord, and I know not where they have laid him*, meaning his *body*.—So it is usual to say of a deceased person, *He was buried at such a time*. And in the inscriptions of sepulchral monuments we frequently meet with this expression, *Here lies such an one*; that is, his *corpse*. Nor are instances uncommon in which the whole being is put for the form. Thus when Cicero says, *Those persons live who have fled from the confinement of the body, as from a prison*; by *persons* must necessarily be understood their *souls*, which are here distinguished from and set in opposition to their *bodies*. And so Virgil represents Æneas as meeting with Dido and some of his Trojan friends in the infernal regions; by which are meant their *ghosts*.

The fourth kind of synecdoche is, when either the matter or form is put for the whole being. Thus *silver* and *gold* are used to signify money made of those metals; as when we say, *I have so much silver*, or *so much gold*. And the word *soul*, both in our own and other languages, is put for the *whole person*. So with us, *a merry soul*, and *a dull soul*; in Cicero, *dear souls*; and in Horace, *candid souls*, are all used in this tropical sense. But this way of speaking occurs nowhere more frequently than in the sacred writings. Thus, for instance, it is said, *All the souls which came with Jacob into Egypt*, meaning the *persons*. And again, *The soul that sinneth it shall die*; from which expression, and others of the like import, some persons, by not attending to the nature of this trope, have been erroneously led to infer that the soul is naturally mortal. But sometimes only part of the matter stands to express the whole essence or being. So we imitate the Latins in using the word *caput* or *head* to denote either a *person* or *thing*. For, as with them *lepidum caput*, so with us *a witty head*, signifies the same as *a man of wit*. And in the same sense, *so many head of cattle* means *so many entire cattle*.

By the fifth sort of synecdoche, the whole of any material thing or quantity, whether continued or discrete, is put for a part of it. So when Cicero says, *A war is kindled through the whole world*, in compliment to his country, he calls the Roman empire *the world*. And this expression is also used by historians. Thus Cornelius Nepos, speaking of the quarrel between Mark Antony and Augustus, tells us, *that each of them desired to be lord of the world*. And in like manner St Luke says, *There went out a decree from Cæsar*

*Augustus, that all the world should be taxed.* So in St Paul's shipwreck, it is said, *They ran the ship aground*, that is, *the head of her*, for it is plain by what follows, that the stern was loose. And as to discrete quantity, our Saviour, using this trope, said he should be *three days and three nights in the heart of the earth.* Though he did not continue three whole days and nights in the grave, but only part of the first and third day, and the whole second day, with the two whole nights between the first and third day, according to our way of reckoning. For he was buried on Friday in the afternoon, and rested in the grave that night, with the following day, which was the Jewish Sabbath, and was risen on the morning of the next day, So that we must necessarily have recourse to this synecdoche, which puts the whole for the part, to clear up that event

By this kind of synecdoche, also, the plural number is sometimes put for the singular. Thus St Matthew says, *The thieves who were crucified with our Saviour reviled him:* though it is plain from St Luke, that only one of them did so. It may also be referred to this trope, when a certain number is put for an uncertain one. So it is an usual way of expression to say, *I have seen or done such a thing an hundred or a thousand times;* when perhaps so many are not really intended, but only in general some considerable number.

The sixth and last kind of synecdoche puts a part of any material thing or quantity for the whole of it. So we say of a man, *He shelters himself under such an one's roof;* that is, *in his house*. And of a fleet, that it *consists of so many sail*; meaning, *so many ships*. And by this trope, that is ascribed to a single person which was done by the assistance of others, and in conjunction with them: As when it is said, that *Hannibal killed forty thousand Romans at the battle of Cannæ;* For an army is an aggregate body, of which the general is the head, and consequently the chief part of it. And to this kind of synecdoche may also be referred such expressions in which the singular number is put for the plural: as if one should say, *A man is liable to be misled by the influence of irregular passions;* meaning *all men*, or *mankind in general*. Or when less than the real number is put for any round number: Thus some ancient writers, when they speak of the Grecian armada that came against Troy, call it a *fleet of a thousand ships*; though, according to Homer's list, it contained 1186. And so likewise the Greek interpreters of the Old Testament are usually called the *Seventy*; whereas, in reality, they were seventy-two.

57 Irony defined and illustrated.

IV. *Irony.* This is *a trope in which one contrary is signified by another:* As if any one should say, *Well done*; when at the same time his design is to intimate that the thing was *ill done.* So that, by this manner of expression, the speaker appears to mean something contrary to the sense of the word he makes use of. Not that the word is changed from its usual signification; but by the circumstances attending the expression, we perceive the contrary to what is spoken is intended. Quintilian observes, that an irony may be known one of these three ways: "By the manner of pronunciation, or from the nature of the person or the thing. For (as he adds) where any of these do not suit with the words, it is plain the speaker intends the contrary." The irony is very plain from the manner of pronunciation in that passage of Terence, where Simo, speaking to his servant by way of reproof, says, "You have taken great care indeed." From the circumstances of the person, when Cicero, addressing to Catiline, says, "He went to your companion, that *excellent man*, Marcus Marcellus." When he calls him an *excellent man*, it is evident he means the contrary; because no good man would be a companion of Catiline. And when he begins his oration for Ligarius with saying, "Cæsar, this is a *new* crime, and never heard of till now," the thing he is speaking of shows it to be an irony; for it was not new, as all who were present very well understood.

The subjects of irony are vices and follies of all kinds. And this way of exposing them is often more effectual than serious reasoning: For many persons, who, either from temper or want of reflection, cannot be moved by the force of an argument, are not proof against the poignancy of wit and raillery. And therefore we find the most grave and serious persons have not declined the use of this trope upon proper occasions. Socrates, whom the oracle pronounced the wisest man of his age, gave so much into it, that he got the name of εἴρων, that is, the *droll*. In the sacred writings we have a remarkable instance of it in the prophet Elijah, where he challenges the priests of Baal to prove the truth of their deity: For it is said expressly, "He mocked them, and said, Cry aloud, for he is a god; either he is talking, or he is pursuing, or he is on a journey, or peradventure he sleepeth, and must be awaked." And Solomon takes the like method to expose the follies of youth by this ironical apostrophe, "Rejoice, O young man, in thy youth," with what follows, which is all ironical. Nay, our Saviour himself thought fit thus to reprove the Jewish doctors, when he says, "Full well ye reject the commandment of God, that ye may keep your own tradition." Where, by the words *full well*, or, as it is in the original, καλως, it is very evident that a severe reprimand was intended.

An irony is used on a variety of occasions, as we shall show from some instances in Cicero. Sometimes he applies it in a way of jest and banter: As when he says, "We have much reason to believe the modest man would not ask him for his debt, when he pursues his life." At other times by way of insult and derision: Thus when he would represent the forces of Catiline as mean and contemptible, "O terrible war, (says he), in which this band of rakes are to march under Catiline! Draw out all your garrisons against this formidable body." Again, at other times, to give the greater force to his argument, he would seem, as it were, by this trope to recal and correct what he had said before; as in his oration for Milo: "But it is foolish in us to compare Drusus, Africanus, Pompey, and ourselves, with Clodius; all our calamities were tolerable, but no one can patiently bear the death of Clodius." Now the character of Clodius was so well known, that all who were present must be sensible he meant the contrary. And, to name no more, an irony is never used to greater advantage, than when it is followed immediately by something very stinging. Thus,

 Thus, speaking of Piso, he says, "You have heard this philosopher: he denies that he was ever desirous of a triumph." And then addressing himself to him, he immediately adds, "O wretch! when you destroyed the senate, sold its authority, subjected your consulate to the tribune, overturned the state, betrayed my life and safety for the reward of a province; if you did not desire a triumph, what can you pretend you did not desire?" This must effectually confound the false gravity at that time assumed by Piso.

## Art. II. Secondary Tropes.

58
Secondary tropes similar in nature, tho' not in name, to the former ones.

Secondary tropes are so called, because they are all of the same nature with the former, and may be referred to some or other of them, though they have received different names.

They are chiefly eight in number; *Antonomasia*, *Communication*, *Litotes*, *Euphemism*, *Catachresis*, *Hyperbole*, *Metalepsis*, and *Allegory*. The three first of these are simple tropes, and may all be referred to a *Synecdoche*. But the five last are of a mixed or complex nature, and not confined to any one of the primary tropes; as will appear in treating upon them in order.

59
A common word often used by way of eminence for any thing remarkable.

I. A common or general word is sometimes used for the proper name of some particular thing or person which upon any account is eminent and remarkable. So we say, *He is gone to the city*, or *he came from the city*, that is, *London*. And by the *Scriptures*, we mean the *Bible*. So likewise, in speaking of persons, *the orator* is used for Cicero, *the poet* for Homer or Virgil, and *the philosopher* for Aristotle: and it is not unusual to say *the apostle*, when we mean St Paul. On the contrary, the proper names of things or persons are sometimes applied to any other of the same character. Thus we use the word *gospel* for any certain and undoubted truth. And *Carthaginian faith* proverbially stood for the greatest falsehood and deceit among the Romans. With the Greeks, *Hercules* signified a *strong man*, *Nestor* a *wise man*, and *Irus* a *beggar*; and the names of *Samson*, *Solomon*, and *Job*, now answer the like characters. Both these ways of expression are often very emphatical, and heighten the idea more than where things are expressed by their own name. To call a good orator *Cicero*, or an excellent poet a *second Virgil*, includes not only an encomium upon the arts themselves, but leads the mind to what is most perfect in them, and was peculiar to those persons. These forms of speech are called *antonomasia*, and come properly under a synecdoche; for in the former the whole is put for a part, and in the latter a part for the whole.

60
A change of persons common in oratory.

II. Nothing is more common with orators than a change of persons. Sometimes, to avoid envy, and prevent the imputation of pride, in assuming to themselves the praise of any laudable action, they ascribe it to their hearers, and do not say, *we*, but *ye did so and so*. At other times, when it is necessary to remind them of something which they have done amiss, or to caution them against some wrong step for the future; to prevent giving offence, they take it upon themselves, or at least join themselves with them, and do not say, *you have done this*, or *do not you do this*; but, *we have done it*, or *let us not do it*. And again, at other times, in compliment to their hearers, they join them as partners in the commendable actions or virtues of other persons; as when the whole body of the people is brought in to share the praise arising from the success of wise counsels or victorious arms. Such ways of speaking often occur both in Demosthenes and Cicero. They are called *communication*, and come properly under a synecdoche of the whole.

III. On the contrary, there is a mode of speech, in which, by denying the contrary, more is intended than the words express. This way of speaking is called *litotes*; and is often used for sake of modesty where a person is led to say any thing in his own praise, or to soften an expression which in direct terms might be found harsh or give offence. As if one should say, *I do not commend you for that*; meaning, *I greatly discommend* or *blame you for it*: where more being understood than the words expressly denote, it is properly a synecdoche of the part. Not that this manner of speaking is always to be so interpreted; but where it is not, there is no trope; which must be judged of by the circumstances of the discourse. But that it frequently is so used, might be easily shown from many instances; though it will be sufficient to mention two or three. Cicero speaking of Cotta, calls him *no mean orator*, whom he had just called *a very great orator*. And he says of Varro, that "he pursued his studies not without industry; and afterwards gives him the character "of a man of the greatest application." Which passages, compared together, plainly show the import of those negative expressions. And a friend of Cicero, writing to him, begins his letter thus: "Although I am sensible the news I send you will not be very pleasant." This news was concerning the death of another friend of Cicero's; and there by the words *not very pleasant*, must, to be sure, be meant *very unpleasant and melancholy*; but he chose that expression in the beginning of his letter, as the softest and least shocking, the better to prepare him for the following account of what that news was. And in this way interpreters explain that passage in St Matthew: *And thou Bethlehem in the land of Judah are not the least among the princes of Judah*, where, by *not the least*, they understand the *greatest*, or *very great*, upon account of the honour it received by the birth of our Saviour, as the words immediately following plainly intimate.

61
Litotes, where, by denying the contrary, more is meant than is expressed.

62
Ungrateful things softened by agreeable words.

IV. When any displeasing or ungrateful thing is expressed by a more soft and agreeable word, it is called *euphemism*. And as the word made use of is either contrary to the proper word, or only different from it, it may be referred to different tropes. The Latins have a soft way of expressing their disregard to a person, by saying *valeat*; which we have borrowed from them, and say, *fare him well*. When the contrary being intended to what is expressed, it comes properly under an *irony*. And as the word *death* carries in it an idea that is disagreeable to human nature, instead of saying a person is dead, we often say *he is deceased*, or *departed*, which we have also taken from the Latins, who use the words *decessit* and *obiit* in the same sense. So that in both languages it comes under a synedoche of the whole; to depart out of life being one sort of departure. But when the evangelist, speaking of Stephen, who was stoned to death, expresses it by

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by ſaying, that *he fell aſleep;* this is a beautiful metaphor, taken from the ſimilitude between the death of a good man and ſleep.

63 Catachreſis, or harſh tropes.

V. *Catachreſis* ſignifies in general any harſh trope, though it is moſt commonly found in metaphors. It is principally uſed by poets, who make choice of it for novelty, or to enforce an expreſſion, where the proper word does not ſeem ſtrong enough. As when Milton, in deſcribing the angel Raphael's deſcent from heaven, ſays, he

*Sails between worlds and worlds;*

where the novelty of the word enlivens the image more than if he had ſaid *flies*. But it is ſometimes found in the graveſt authors, and even in the ſacred writings. So we read of the *blood of the grape*. And Solomon ſays, *the horſe-leech hath two daughters*. In all theſe inſtances the trope is a metaphor. But when St John ſays in the Revelations, *I turned to ſee the voice that ſpake to me*, it is here a metonymy of the adjunct; the word *voice* being put for the perſon who uttered it. In St Matthew we read of *Simon the leper;* not that he was then a leper, but had been ſo, and was cured; which is a *ſynecdoche* of the part. And when a criminal is ſaid *to have had his reward*, that is, his puniſhment, it is an *irony*.

64 Hyperbole the boldeſt of all tropes.

VI. *Hyperbole* is the boldeſt of all tropes; for it exceeds the ſtrict bounds of truth, and repreſents things either greater or leſs, better or worſe, than they really are. But the repreſentation is made in ſuch a manner as not to impoſe on the hearers. For an *hyperbole* is not uſed to define or deſcribe any thing accurately, but only to magnify or depreſs it in a conſiderable degree, when we either cannot or do not chooſe to repreſent it exactly. The exceſs in this trope is called *auxeſis;* as when we ſay of any thing that is very high, *it reaches to the ſkies*. The defect, or contrary extreme, is termed *meioſis:* So we ſay of a very [illegible] perſon, *he is nothing but ſkin and bones*, or *a mere* [illegible]*ton*. It is principally metaphorical, but ſo[illegible] ken from other tropes. When Saul and Jona[illegible] ſaid to have been *ſwifter than eagles, and ſtronger th*[illegible]*ions*, the expreſſion is founded in ſimilitude, and is therefore a metaphor. When, inſtead of ſaying Cato was a very virtuous man, the hiſtorian calls him *the image of virtue;* it is an hyberbolical metonymy of the adjunct for the ſubject. And when we read in the Moſaic hiſtory *of cities fenced up to heaven*, there is a *ſynecdoche*. But if a man of weak ſight be ſaid *to be eagle-eyed*, it is an *irony*. Thoſe hyperboles which are expreſſed comparatively, are commonly moſt emphatical, becauſe they ſhow a peculiarity in the exceſs. To ſay a thing is *as light as a feather*, carries the idea very far; but to ſay *it is lighter*, not only carries it ſtill farther, but alſo heightens it, by leaving the mind at an uncertainty where to fix the limits.

65 Metalepſis, where two or more tropes are meant under one word.

VII. Sometimes two or more tropes, and thoſe of a different kind, are contained under one word; ſo that ſeveral gradations, or intervening ſenſes, come between the word that is expreſſed, and the thing deſigned by it. And this is called a *metalepſis*. The conteſts between Sylla and Marius proved very fatal to the Roman ſtate. Julius Cæſar was then a young man. But Sylla obſerving his aſpiring genius, ſaid of him, "In one Cæſar there are many Mariuſes." Now in this expreſſion there is a metalepſis. For the word *Marius*, by a *ſynecdoche*, or *antonomaſia*, is put for any ambitious and turbulent perſon; and this again, by a *metonymy* of the cauſe, for the ill effects of ſuch a temper to the public. So that Sylla's meaning, diveſted of theſe tropes, was, that Cæſar would prove the moſt dangerous perſon to the Roman ſtate that ever was bred in it: which afterwards proved true in the event. So when Virgil, deſcribing that part of the African coaſt where Æneas arrived with his ſhips, ſays, *A dark wood hung over it;* the word *dark*, by a metonymy of the effect, is put for *ſhady*, and that again by the ſame trope for *thick;* for his meaning is, a *thick wood*. But the words of Dido, in the ſame poet, contain a larger gradation, when ſhe ſays,

*Happy, ah truly happy, had I been,*
*If Trojan ſhips our coaſts had never ſeen.*

In which expreſſion, firſt by a metonymy of the adjunct, the ſhips are put for the Trojans in the ſhips: and theſe, by a ſynecdoche of the whole, for Æneas, who was one of them; and again his arriving on the coaſt, by a metonymy of the cauſe, for her ſeeing him; and laſtly, her ſeeing him, by the ſame trope, for the paſſion ſhe had for him. So that her meaning is, ſhe had been happy, if ſhe had never entertained a paſſion for Æneas. This trope is more frequently to be met with in poets than in orators, as they take greater liberty in uſing diſtant alluſions than is ſuited to that perſpicuity of expreſſion which is required in oratory. But as Quintilian has well obſerved, all the intermediate links of the chain in this trope are of no further uſe than to lead the mind gradually from the firſt to the laſt, the better to perceive their connection. As in the example laſt mentioned, relating to Dido, if we drop all the intervening ſteps, and connect the words expreſſed with what is directly intended, they will be found to contain a very remote cauſe put for the effect, which comes under a metonymy. On the contrary, in the ſecond example, where *dark* ſtands for *thick*, the effect is put for a remote cauſe. And the firſt, which is founded in a ſimilitude of temper between Cæſar and Marius, belongs to a *metaphor*.

66 Allegory, a continuation of tropes thro' ſeveral ſentences.

VIII. *Allegory*. As a metalepſis compriſes ſeveral tropes in one word, ſo this is a continuation of ſeveral tropes in one or more ſentences. Thus Cicero ſays, "Fortune provided you no field, in which your virtue could run and diſplay itſelf:" where the words *field* and *run* are metaphors taken from corporeal things, and applied to the mind. And in another paſſage, ſpeaking of himſelf, he ſays, "Nor was I ſo timorous, that after I had ſteered the ſhip of the ſtate through the greateſt ſtorms and waves, and brought her ſafe into port, I ſhould fear the cloud of your forehead, or your colleague's peſtilent breath. I ſaw other winds, I perceived other ſtorms, I did not withdraw from other impending tempeſts; but expoſed myſelf ſingly to them for the common ſafety." Here the ſtate is compared to a ſhip, and all the things ſaid of it under that image are expreſſed in metaphors made uſe of to ſignify the dangers with which it had been threatened. And indeed allegories generally conſiſt of metaphors; which being the moſt beautiful trope, a number of them well choſen and put together is one of the fineſt and brighteſt ornaments in language, and exceeds

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exceeds a single metaphor in lustre, as a constellation does a separate star. It is true, that allegories are sometimes found in other tropes; but this is very rare. In that known expression of Terence, the tropes are all metonymies: *Without Ceres and Bacchus, Venus grows cold;* that is, divested of the tropes, *Without meat and drink, love dies.* And Samson's riddle is made up of synecdoches: "Out of the eater came forth meat, and out of the strong came forth sweetness." But there is no small skill required in the right management of allegories. For care should be taken that the same kind of trope be carried through the whole, so as to compose one uniform and consistent set of ideas: otherwise they dress up a chimera, a thing that has no existence, and of which the mind can form no perception. And, as Quintilian says very justly, "to begin with a tempest and end with a fire, would be very ridiculous and unnatural." It is likewise very necessary that the allusions be all plain and evident, especially where the name of the thing alluded to is not expressed. These are called *pure allegories.* As that of Cicero: "So it happens, that I, whose business it is to repel the darts, and heal the wounds, am obliged to appear before the adversaries have thrown any dart; and they are allowed a time to attack us, when it will not be in our power to avoid the assault; and if they throw a poisonous dart, which they seem prepared to do, we shall have no opportunity to apply a remedy." The tropes here are all taken from military affairs, without any intimation what they are applied to. But that is plain from the context of the discourse. For he is speaking of the disadvantages he laboured under in defending his client against those of the opposite side, and so applies to the bar those terms which were proper to the field. But where the reference is not evident, it becomes a riddle: which is nothing else but an obscure allegory. To avoid this, therefore, the best writers generally use what they call *mixed allegories;* that is, such wherein the proper name of the thing is expressed, which the whole similitude respects. Of this kind is that in the speech of king Philip of Macedon, given us by Justin, where he says, "I perceive that cloud of a dreadful and bloody war arising in Italy, and a thunder-storm from the west, which will fill all places with a large shower of blood, wherever the tempest of victory shall carry it." The proper words *war, blood,* and *victory,* being joined to the tropes *cloud, shower,* and *tempest,* in this sentence, render the several parts of the similitude plain and evident. Quintilian thinks those allegories most beautiful, where the whole similitude is expressed, and those words, which in their proper sense relate to one of the two things between which the comparison is made, are allegorically applied to the other: As when Cornelius Nepos says of Atticus, "If that pilot gains the greatest reputation who preserves his ship in a boisterous and rocky sea; ought not he to be thought a man of singular prudence, who arrived in safety through so many and so great civil tempests?" These are the allegories with which orators are chiefly concerned.

## § 2. *Of Figures.*

This term seems to have been borrowed from the stage, where the different habits and gestures of the actors, suitable to the several characters they sustained, were by the Greeks called σχηματα, and by the Latins *figuræ:* And it is not unusual with us to say of a person, both with respect to his dress and action, that he makes *a very bad,* or *a very graceful, figure.* And as language is the dress, as it were of our thoughts, in which they appear and are represented to others; so any particular manner of speaking, may, in a large sense of the word, be called its *figure,* in which latitude writers sometimes use it. But rhetoricians have restrained the sense of the word to such forms of speech as differ from the more common and ordinary ways of expression; as the theatrical habits of actors, and their deportment on the stage, are different from their usual garb and behaviour at other times. A *figure* therefore, in the sense it is used by rhetoricians, is, *A mode of speaking different from, and more beautiful and emphatical than, the ordinary and usual way of expressing the same sense;* or, in other words, *That language which is suggested either by the imagination or the passions.* Now as the habits and gestures of our bodies are in a manner infinitely variable, so it is plain that the different forms of speech are almost innumerable. But every alteration from the common manner ought not to be esteemed a figure, nor deserves that character. It must contain some beauty, or express some passion, to merit a place among rhetorical figures, and be marked out for imitation.

67 The term *figure* apparently borrowed from the stage.

The subject of *figure* seems to have been one of the last things which was brought into the art of oratory, in order to complete it. Aristotle, who treats so accurately upon other parts, says very little of this. But the Greek writers who came after him have abundantly supplied that deficiency. It is to them we owe the chief observations that have been made on this subject. They took notice of the several modes and turns of expression, observed their force and beauty, and gave them particular names by which they might be known and distinguished from each other. And indeed they have treated the matter with such minuteness and subtilty, that Quintilian seems, not without reason, to think they have multiplied figures to an excess. But though it was so late before they were taken notice of, and introduced into the art of speaking, yet the use of them in discourse was doubtless very ancient. The author of Homer's life, which some have ascribed to Plutarch, has shown, by examples taken out of him, that there is scarce a figure mentioned by rhetoricians, but is to be met with in that most ancient poet. And, if we consider the nature of speech, we shall easily perceive that mankind must have been under a necessity very early to introduce the use of *tropes* for supplying the want of proper words to express their simple ideas: so the like necessity must have put them upon the use of figures to represent their different passions; though both of them were afterwards increased, and improved in such a manner as to become the chief ornaments of language. The passions of men have been always the same; they are implanted in us by nature, and we are all taught to discover them by the same ways. When the mind is disturbed, we show it by our countenance, by our actions, and by our words. Fear, joy, anger, alter the countenance, and occasion different emotions and gestures of the whole body. And we know with what

what passion a man is affected, by hearing his words, though we do not see him. He does not express himself as he usually does at other times when cool and sedate. Objects appear to him in a different view, and therefore he cannot but speak of them in a different way. He interrogates, he exclaims, he admires, he appeals, he invokes, he threatens, he recals his words, repeats them, and by many other different turns of expression varies his speech no less than his countenance, from his common and ordinary manner. Now as nature seems to teach us by these figurative expressions how to represent the different commotions of our minds, hence some have thought fit to call figures *the language of the passions*. And as these are given us, among other wise ends, to excite us the better to provide for our preservation and safety, this is done sometimes by force of arms, and at other times by discourse. And therefore Cicero very handsomely compares the conduct of an orator to the exercises of the palæstra: in which, as each combatant endeavours not only to defend himself, and attack his adversary, but likewise to do both with decency; so the principal weapons of an orator, as he represents them, are figures, which being no less the ornaments of language than images of our passions, answer all these purposes. Besides, figures chiefly distinguish the different kinds of style, furnish it with an agreeable variety, and often serve to represent things in a clear and forcible manner.

From this short account of the nature of figures, the advantage of them to an orator is very evident. They are a sort of natural eloquence, which every one falls into without attending to it, suitably to that temper of mind with which he is affected himself, and is desirous to affect others. In a cool and sedate discourse, such figures as convey our sentiments with the greatest strength and evidence are most proper. And there are others, which are suited to brighten and enliven more gay and sprightly subjects. Others again are more peculiarly adapted to express the disorders and perturbations of the mind. To repeat the same thing again would many times be deemed a tautology, and impertinent; but to do this when the mind is ruffled, is not only allowable, but the repetition renders it more strong and affecting. So likewise to interrogate, exclaim, or admire, under the influence of a passion, impresses the hearers, and disposes them to attention; whereas at another time perhaps such ways of speaking would scarce be consistent with prudence. There is a natural sympathy in mens minds, which disposes them to receive impressions from those with whom they converse. Thus one gay and pleasant companion gives a cheerfulness and vivacity to a whole company; whereas, on the contrary, one who is dull and phlegmatic damps the spirits of all about him, and affects them with the same gloomy temper. Figures are peculiarly serviceable to an orator for answering these different intentions. And as he finds them in life, from thence he must copy them; as a painter does the features of the countenance, and the several parts of the body; figures being to the one what lines and colours are to the other. The design of Catiline to destroy the Roman state and burn the city, is a story well known. There was an army drawn together at a proper distance to favour the undertaking; and others were left in Rome, who had their parts assigned them for burning the city, and destroying those who should escape the flames. And, in a word, every thing was ready for putting in execution this horrid and barbarous scheme. So that nothing retarded it but the taking off Cicero, who was then consul, which was thought necessary to be done first. Cicero, upon information of the design against his life, finds means to prevent it, and the same day calls together the senate. And Catiline, who was a man of consummate boldness, had the confidence to appear in that assembly. Upon their meeting, Cicero opens to them the whole affair of the conspiracy, and the design against himself, in a most warm and pathetic harangue. In which he had two things in view; to raise the indignation of the senate against the conspirators, and particularly against Catiline; and, either by terrifying or exasperating him, to oblige him to leave the city. Now he does not begin this speech in his usual manner at other times, by addressing to his audience, bespeaking their favour and attention, or letting them gradually into the design of what he was about to say; but as Catiline was present, he immediately falls upon him with vehemence, in the following manner: "How far, Catiline, will you abuse our patience? How long will your fury insult us? What bounds will you set to your unbridled rage? Does neither the night-guard of the palace, nor the city-watch, nor the peoples fear, nor the agreement of all good men, nor the meeting of the senate in this fortified place, nor the countenances and looks of this assembly, at all move you? Do not you perceive your designs are discovered, and that all who are present know of your conspiracy? Who of us, do you think, is ignorant of what you did the last night, and the night before, where you was, who was with you, and what you resolved on? O times! O manners! The senate knows this, the consul sees it; and yet this man lives!—lives? nay, comes into the senate, joins in the public counsels, observes and marks out each of us for destruction!" And in the same impetuous strain he proceeds through his whole speech, interspersing a great variety of the like strong and moving figures. And the discourse had its desired effect: for when Catiline stood up afterwards to make his defence, the whole senate was so inflamed, and their resentments against him rose so high, from what Cicero had said, that they had not patience to hear him speak; upon which he left both them and the city. Had Cicero, instead of venting his just indignation against the author of so barbarous and inhuman a design, in the manner he did, by figures suited to strike the passions of his hearers; had he, instead of this, attempted to reason with him, and told the story in a cold and lifeless manner, he would have exposed himself to the contempt of Catiline; and by leaving the senate little or nothing moved at what he said, prevented perhaps their coming to those speedy and vigorous resolutions which were necessary at so critical a juncture. Let us suppose him to have expostulated with Catiline in much the same words as before, but thrown into a different form, and divested of those pathetic figures. As thus: "Catiline, you have really abused our patience to a great degree. You have insulted us with your furious proceedings a long while. You seem to have fixed no bounds to your

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your unbridled rage. Neither the night-guard of the palace, nor the city-watch, nor the peoples fear, nor the agreement among good men, nor the calling together of the senate in this fortified place, nor the countenances and looks of this assembly, appear to move you in the least. I assure you we are all of us apprised of what you did the last night, and the night before, where you was, and who were with you, and what resolutions you came to. These are sad times, the age is very degenerate; that the senate should know all this, the consul see it; and yet that this man should live, come into the senate, hear all our debates, and mark us out to destroy us." You see the sense is entirely the same, and the words too in a great measure; so that there is little more than an alteration in the form of them. And yet who does not perceive how flat and languid such a way of talking must have appeared at that time? and how much it loses of that spirit and energy, which shows itself in Cicero's manner of expression? Had he delivered himself thus, it might indeed have made the senate look upon Catiline as an abandoned wretch, lost to all virtue and goodness, and perhaps have moved some to pity him on that account; as we are easily induced to compassionate persons in such circumstances, especially when descended from noble and virtuous ancestors, which was his case. But sure it would have been ill suited to fire their minds with that generous regard for their country, and the necessary precautions for its security, which the circumstances of the state then required. Nor would Catiline have been at all deterred by it, but rather encouraged in the prosecution of his designs, from the little effect a speech so managed must probably have had upon the minds of the senators. But Cicero knew very well that the passions of mankind are the springs of action; that it is many times not sufficient for an orator to convince their minds, by setting the truth in a clear light; but he must also raise their hopes, alarm their fears, inflame their anger, or excite some other suitable passion, before they will be brought to act with that zeal and fervour which the case may require. And as he was admirably well skilled in this art of touching the passions, he seldom fails to fix upon the proper methods of doing it, and makes choice of such figures and modes of speaking as in the strongest manner represent the emotions of his own mind. For every passion is not to be expressed by the same figures, any more than it is drawn by the same lines, or painted with the same colours. When Dido finds that Æneas is about to leave her, she uses all her arts to detain him. And as persons in great distress are seldom at a loss to express their condition in the most affecting way; she discovers her fear, anger, revenge, with the whole crowd of disorders which then possessed her mind, in a variety of moving figures, suited to raise the counter passions in his breast, as is finely represented by Virgil in that artful speech he has made for her, which we forbear to recite for no other reason but the length of it. But what particular figures are most accommodated to answer the several ends proposed by them, will best appear when we come to treat of them separately.

We shall therefore now proceed to lay down a few directions for the proper use of figures. And first they should always be accommodated to the sentiments, and rise in proportion to the images designed to be conveyed by them. So far as they are founded in reason, they are suited to impress the mind; but where the language outstrips the thought, though it may please the ear, and some weak persons may be carried away with a pomp of words, yet an intelligent hearer will soon see through the thin and airy dress. It is the sense which gives weight to the figure, as that by striking the imagination awakens the mind, and excites it to act in conformity to reason. Again, in the use of pathetic figures, it is generally better to be nervous than copious, that the images, by their closer union, may impress the mind with greater force and energy; though in such figures as are designed for ornament or illustration, a more diffusive way of painting is sometimes agreeable. But farther, the too frequent use of figures ought to be avoided. For what was observed in relation to tropes, is also true with respect to these; that a great number of them is apt to darken and obscure the style. And besides, Cicero's reflection in this case is very just, That "it is hard to say, what should be the reason, that those things, which most affect us with a sensible pleasure, and at first sight soonest move us, do likewise soonest cloy and satiate us." But that it is so, we find by common experience. Lastly, figures should be so interwoven in a discourse, as not to render the style rough and uneven, sometimes high and at other times low; now dry and jejune, then pompous and florid. In a word, they should rather seem to arise from nature than art; to offer themselves, than to be the effect of study; and to appear not like patches upon a face, but the agreeable beauty of a sound and healthful complexion. But of this we shall have occasion to speak more at large hereafter, in treating upon the different kinds or characters of style.

As to the division of figures, which is what remains to be considered, they are usually divided into two sorts, figures of words, and figures of sentences. The difference between them consists in this; that in the former, if you alter the words, or sometimes only the situation of them, you destroy the figure; but in the latter the figure remains, whatever words are made use of, or in what manner soever the order of them is changed. Thus when the name of a person or thing is repeated, to intimate some known property or quality belonging thereto, it is a verbal figure called *place*. Cicero was a true patriot and hearty lover of his country. And therefore we shall use this figure in saying, that *at the time of Catiline's conspiracy Cicero appeared like Cicero*. The sense would remain the same, but the figure would be lost, if we should alter the words, and say, *at that time Cicero appeared like himself*. So when two or more sentences, or members of a sentence, end with the same word, it is called *epistrophe*; as when we say, *To lose all relish of life, is in effect to lose life*. But if only the order of the words be changed in the latter clause thus, *To lose all relish of life, is to lose life in effect*; the figure vanishes. And this is the nature of the verbal figures. But it is not so in figures of sentences: they continue the same, whatever alterations are made in the

Ostracism brick, some that it was a piece of bark; and others assert, that it was a shell. The word admits most of these interpretations. But what determines its true sense, is the epithet given it by ancient authors, of *ceramitè mastix*; which words signify, "The punishment of potter's clay;" and this expression seems to us a proof, that the word [illegible] when applied on this occasion, signifies a "piece of baked earth, in the form of a shell;" and undoubtedly the Latin authors had this idea of the word here, for they translated it by *testula*.

The ancients are likewise divided with regard to the time when ostracism was instituted. But they all agree, that the person who moved the law was its first victim. But as to the name of its patron, and the time of its establishment, they differ extremely. Many are of opinion, that ostracism owes its origin to very remote times.

However that be, the punishment of ostracism was inflicted by the Athenians when their liberty was in danger. If, for instance, jealousy or ambition had sowed discord among the chiefs of the republic; and if different parties were formed, which threatened some revolution in the state; the people assembled to propose measures proper to be taken in order to prevent the consequences of a division which in the end might be fatal to freedom. Ostracism was the remedy to which they usually had recourse on these occasions; and the consultations of the people generally terminated with a decree, in which a day was fixed for a particular assembly, when they were to proceed to the sentence of ostracism. Then they who were threatened with banishment, omitted no assiduity or art which might gain them the favour of the people. They made harangues to evince their innocence, and the great injustice that would be done them if they were banished. They solicited, in person, the interest of every citizen; all their party exerted themselves in their behalf: they procured informers to vilify the chiefs of the opposite faction. Some time before the meeting of the assembly, a wooden inclosure was raised in the forum, with ten doors, *i. e.* with as many as there were tribes in the republic; and when the appointed day was come, the citizens of each tribe entered at their respective door, and threw into the middle of the inclosure the small brick on which the citizen's name was written whose banishment they voted. The archons and the senate presided at this assembly, and counted the billets. He who was condemned by 6000 of his fellow-citizens, was obliged to quit the city within ten days; for 6000 voices, at least, were requisite to banish an Athenian by the ostracism.

The Athenians, without doubt, foresaw the inconveniences to which this law was subject; but they chose rather, as Cornelius Nepos hath remarked, sometimes to expose the innocent to an unjust censure, than to live in continual alarms. Yet as they were sensible that the injustice of confounding virtue and vice would have been too flagrant, they softened, as much as they could, the rigour of ostracism. It was not aggravated with the circumstances which were most dishonourable and shocking in the ordinary mode of exile. They did not confiscate the goods of those who were banished by ostracism. They enjoyed the produce of their effects in the places into which they were banished; and they were banished only for a certain time. But in the common banishment, the goods of the exiles were always confiscated, and no hopes were given them of ever returning to Athens.

Ostracism. The scholiast of Aristophanes informs us of a third difference betwixt ostracism and the common banishment. He says, that a particular place of retirement was assigned to those wh[illegible] banished by ostracism, which was not appoi[illegible]her exiles[illegible] suspect, however, the [illegible]ation[illegible] Themistocles was certainly not lim[illegible] in his [illegible]. That great man, as we are told by Thucydides, tho' his chief residence was at Argi, travelled over all the Peloponnesus.

This punishment, far from conveying the idea of infamy, became, at Athens, a proof of merit, by the objects on which it was inflicted; as Aristides the sophist justly observes, in his second declamation against the Gorgias of Plato, where he says, that ostracism was not an effect of [illegible] of the people against those whom it [illegible] the law, whether good or bad, (for he enters not into an examination of the question), was only meant to prune the luxuriant growth of transcendent merit; that it condemned to an exile of ten years, only those illustrious men who were accused of being exalted far above other citizens by their conspicuous virtue; and that none of that public indignation was shown to the exiles by ostracism, which commonly breaks out against criminals.

Such were the mitigations with which this law was introduced among the Athenians: and by them we see that they were sensible of all the inconveniences to which it was subject. They were indeed [illegible] enlightened a people, not to foresee the many in[illegible]ces of injustice which it might produce; that [illegible] some respects it would be favourable to liberty [illegible]n others it would be its enemy, by condemning citizens without allowing them a previous defence, and by making a capricious and envious people arbiters of the fate of great men; that it might even become pernicious to the state, by depriving it of its best subjects, and by rendering the administration of public affairs an odious employment to men of capital talents and virtue.

However great the inconveniences of ostracism were, it would not have been impossible to avoid them; and we may add, that this law would have been of service to the state, if the people by whom it was instituted had always had discernment enough only to give it force on such occasions as endangered liberty. But its fate was like that of almost all other laws which the wisest legislators have planned for the good of communities. Destined by their institution to maintain order, to repress injustice, [illegible] to protect innocence, men have found ways to per[illegible] their application, and have made them [illegible]ments to gratify their private passions. Thus ost[illegible] was established to prevent the dangerous enterpr[illegible] of the great, and to preserve the vigour of the demo[illegible]cy; but the people of Athens, naturally jealous a[illegible] envious, exerted that law, to remove men of eminent merit from the state, by whose presence they were reproved and intimidated. The fear of tyranny was commonly but a specious pretext with which they veiled their malignity. The

Ostracites Ostrea.

repeated victories which they had gained over the Persians, had rendered them, says Plutarch, proud and insolent. Intoxicated with their prosperity, they arrogated all its glory to themselves; they were jealous of those citizens whose political and military talents were the subjects of public eulogium. They thought the glory acquired by great men diminished their own reputation. An Atheni[illegible] sooner distinguished himself by [illegible]did actio[illegible] marked out as a victim [illegible]blic e[illegible] reputation was a sufficient [illegible] his banishment.

OSTRACITES, in natural history, a name used for the fossile oysters, common in many parts of England. They are of various shapes and kinds; and the name is by some authors made to signify the shell itself, when preserved in its native state and condition; as is the case with those about Woolwich and Blackheath; and by others, the stones cast or formed in those shells, or in cavities, from whence they have been washed away and [illegible] both these cases the stone carries the [illegible]ance of the shell, even in its nicest lineaments; in the first case, bearing every mark of the inside, in the other of the outer surface. We have this stone in great plenty in many parts of England; and it is very famous, in some places, for its virtues, in cases of the gravel, and the like complaints.

OSTREA, the OYSTER, in zoology, a genus belonging to the order of vermes testacea. The shell has two unequal valves; the cardo has no teeth, but a small hollowed one with transverse lateral streaks. There are 31 species, principally distinguished by peculiarities in their shells. The common oyster is reckoned an excellent food; and is eaten both raw and variously prepared. The character of the genus, in the words of Barbut, "The animal a tethys; the shell bivalve, unequivalve, with something like ears; the hinge void of teeth, with a deep oval hole, and transverse streaks on the sides There is no womb nor anus." The genus is divided into four families, of which ostrea is the last. See PECTENS. The same author gives us the following enlarged account of the oyster.

Plate CCCLXIX

"This sea-fish occupies in the scale of nature one of the degrees the most remote from perfection; destitute of defensive weapons and progressive motion, without art or industry, it is reduced to mere vegetation in perpetual imprisonment, though it every day opens regularly to enjoy the element necessary to its preservation. The animal figure, and the springs of its organization, are scarce discernible through the coarse and shapeless mass; a ligament placed at the summit of the shell serves as an arm to its operations. Oysters are reputed to be hermaphrodites; the spawn which they cast in May adheres to the rocks and other matters at the bottom of the sea; and in the space of 24 hours is provided with shells in which are contained other oysters, that never leave the spot on which they were fixed, till the greedy fisherman tears them from the element. The green oysters eaten at Paris are commonly brought from Dieppe. Their colour is owing to the care taken to bed them in creeks, encompassed with verdure, where they acquire their delicacy. Common oysters should be fresh, tender, and moist. The most esteemed are those caught at the mouth of rivers, and in clear water. Great account is made of oysters from Brittany, but still greater of those that come from Marennes in Saintonge. Preference is given to those that are edged with small brown fringe, or beard, which epicures call fecundated oysters; but that those are females is a mistake. The want of fresh water renders oysters hard, bitter, and unpalatable. Mud and sea weeds destroy them in their very birth; galangal root, muscles, scollops, sea stars, and crabs, are formidable enemies to the oyster. There are found in Spain red and russet coloured oysters; in Illyria, brown coloured, with the flesh black; and in the Red Sea, of the colour of the Iris. Oysters of the mangle-tree are of two sorts; those of St Domingo are delicate, adhering to the stumps of the trees that dip in the water. The negro divers cut them off with a bill, and they are served upon table with the roots."

Ostrea.

Britain has been noted for oysters from the time of Juvenal, who, satyrizing Montanus an epicure, says,

*Circæis nata forent, an*
*Lucrinum ad saxum, Rutupinove edita fundo,*
*Ostrea, callebat primo deprendere morsu.*

He, whether Circe's rock his oysters bore,
Or Lucrine lake, or distant Richborough's shore,
Knew at first taste.

The luxurious Romans were very fond of this fish, and had their layers or stews for oysters as we have at present. Sergius Orata was the first inventor, as early as the time of L. Crassus the orator He did not make them for the sake of indulging his appetite, but through avarice, and made great profits from them. Orata got great credit for his Lucrine oysters; for, says Pliny, the British were not then known.

Pennant's Brit Zool vol IV. p 102.

The ancients ate them raw, having them carried up unopened, and generally eating them at the beginning of the entertainment, but sometimes roasted. They had also a custom of stewing them with mallows and ducks, or with fish, and esteemed them very nourishing.

Britain still keeps its superiority in oysters over other countries. Most of our coasts produce them naturally; and in such places they are taken by dredging, and are become an article of commerce, both raw and pickled. The very shells, calcined, become an useful medicine as an absorbent. In common with other shells, they prove an excellent manure.

Stews or layers of oysters are formed in places which nature never allotted as habitations for them. Those near Colchester have been long famous; at present there are others that at least rival the former, near the mouth of the Thames. The oysters, or their spats, are brought to convenient places, where they improve in taste and size. It is an error to suppose, that the fine green observed in oysters taken from artificial beds, is owing to copperas; it being notorious how destructive the substance or the solution of it is to all fish. We cannot give a better account of the cause, or of the whole treatment of oysters, than what is preserved in the learned bishop Sprat's history of the Royal Society, from p. 307 to 309.

"In the month of May the oysters cast their spawn, (which the dredgers call their *spats*): it is like to a drop of candle, and about the bigness of a half-penny.

 penny. The ſpat cleaves to ſtones, old oyſter-ſhells, pieces of wood, and ſuch like things, at the bottom of the ſea, which they call *cultch*. It is probably conjectured, that the ſpat in 24 hours begins to have a ſhell. In the month of May, the dredgers (by the law of the admiralty court) have liberty to catch all manner of oyſters, of what ſize ſoever. When they have taken them, with a knife they gently raiſe the ſmall brood from the clutch, and then they throw the clutch in again, to preſerve the ground for the future, unleſs they be ſo newly ſpat, that they cannot be ſafely ſevered from the cultch; in that caſe they are permitted to take the ſtone or ſhell, &c. that the ſpat is upon, one ſhell having many times 20 ſpats After the month of May, it is felony to carry away the cultch, and puniſhable to take any other oyſters, unleſs it be thoſe of ſize, (that is to ſay) about the bigneſs of an half-crown piece, or when, the two ſhells being ſhut, a fair ſhilling will rattle between them.

"The places where theſe oyſters are chiefly catched, are called the *Pent-Burnham*, *Malden*, and *Colne-waters*; the latter taking its name from the river of Colne, which paſſeth by Colcheſter, gives name to that town, and runs into a creek of the ſea, at a place called the *Hythe*, being the ſuburbs of the town. This brood and other oyſters they carry to the creeks of the ſea, at Brickelſea, Merſy, Langno, Fingrego, Wivenho, Toleſbury, and Saltcoaſe, and there throw them into the channel, which they call their *beds* or *layers*, where they grow and fatten; and in two or three years the ſmalleſt brood will be oyſters of the ſize aforeſaid. Thoſe oyſters which they would have green, they put into pits about three feet deep in the ſalt marſhes, which are overflowed only at ſpring-tides, to which they have ſluices, and let out the ſalt water until it is about a foot and a half deep. Theſe pits, from ſome quality in the ſoil co-operating with the heat of the ſun, will become green, and communicate their colour to the oyſters that are put into them in four or five days, though they commonly let them continue there ſix weeks or two months, in which time they will be of a dark green. To prove that the ſun operates in the greening, Toleſbury pits will green only in ſummer; but that the earth hath the greater power, Brickelſea pits green both winter and ſummer: and for a further proof, a pit within a foot of a greening pit will not green; and thoſe that did green very well, will in time loſe their quality. The oyſters, when the tide comes in, lie with their hollow ſhell downwards; and when it goes out, they turn on the other ſide: they remove not from their place, unleſs in cold weather, to cover themſelves in the ouſe. The reaſon of the ſcarcity of oyſters, and conſequently of their dearneſs, is, becauſe they are of late years bought up by the Dutch.

"There are great penalties by the admiralty court laid upon thoſe that fiſh out of thoſe grounds which the court appoints, or that deſtroy the cultch, or that take any oyſters that are not of ſize, or that do not tread under their feet, or throw upon the ſhore, a fiſh which they call a *five finger*, reſembling a ſpur-rowl, becauſe that fiſh gets into the oyſters when they gape, and ſucks them out.

"The reaſon that ſuch a penalty is ſet upon any that ſhall deſtroy the cultch, is, becauſe they find that if that be taken away, the ouſe will increaſe, and the muſcles and cockles will breed there, and deſtroy the oyſters, they having not whereon to ſtick their ſpat.

"The oyſters are ſick after they have ſpat; but in June and July they begin to mend, and in Auguſt they are perfectly well: [illegible] oyſter is black-ſick, having a black ſubſta[illegible] the female white-ſick (as they term it) having [illegible] ſubſtance in the fin. They are ſalt in the pits, [illegible] in the layers, but ſalteſt at ſea."

The oyſter affords the curious in microſcopic obſervations a very pleaſing entertainment. In the clear liquor many little round living animalcules have been found, whoſe bodies being conjoined, form ſpherical figures, with tails, not changing their place otherwiſe than by ſinking to the bottom, as being heavier than the fluid; theſe have been ſeen frequently ſeparating, and then coming together again. In other oyſters, animalcules of the ſame kind were found, not conjoined, but ſwimming by one another, whence they ſeemed in a more perfect ſtate, and were judged by Mr Leeuwenhoek to be the animalcules in the roe or ſemen of the oyſter.

A female oyſter being opened, incredible multitudes of ſmall embryo oyſters were ſeen, covered with little ſhells, perfectly tranſparent, and ſwimming along ſlowly in the liquor; and in another female, the young ones were found of a browner colour, and without any appearance of life or motion.

Monſieur Joblot alſo kept the water running from oyſters three days, and it appeared full of young oyſters ſwimming about nimbly in it; theſe increaſed in ſize daily: but a mixture of wine, or the vapour of vinegar, killed them.

In the month of Auguſt oyſters are ſuppoſed to breed, becauſe young ones are then found in them. Mr Leeuwenhoek, on the 4th of Auguſt, opened an oyſter, and took out of it a prodigious number of minute oyſters, all alive, and ſwimming nimbly about in the liquor, by means of certain exceeding ſmall organs, extending a little way beyond their ſhells; and theſe he calls their beards. In theſe little oyſters, he could diſcover the joinings of the ſhells; and perceived that there were ſome dead ones, with their ſhells gaping. Theſe, though ſo extremely minute, are ſeen to be as like the large oyſters in form as one egg is to another.

As to the ſize of them, he computes, that 120 of them in a row would extend an inch; and conſequently, that a globular body, whoſe diameter is an inch, would, if they were alſo round, be equal to 1,728,000 of them. He reckons 3000 or 4000 are in one oyſter, and found many of the embryo oyſters among the bairds; ſome faſtened thereto by ſlender filaments, and others lying looſe: he likewiſe found animalcules in the liquor 500 times leſs than the embryo oyſters.

It is not very uncommon to ſee on oyſter-ſhells, when in a dark place, a ſhining matter or bluiſh light, like a flame of brimſtone, which ſticks to the fingers when touched, and continues ſhining and giving light for a conſiderable time, though without any ſenſible heat. This ſhining matter being examined with a microſcope, was found to conſiſt of three ſorts of animalcules;

Oſtrich ‖ Oſweſtry.

cules; the firſt whitiſh, and having 24 or 25 legs on a ſide, forked, a black ſpeck on one part of the head, the back like an eel with the ſkin ſtripped off. The ſecond ſort, red, reſembling the common glow-worm, with folds on its back, but legs like the former; a noſe like a dog's, and one eye in the head. The third ſort, ſpeckled, with a head like a ſole, with many tufts of whitiſh hairs on th[illegible] it. Some much larger and greyiſh might[illegible]ving great heads, two horns like a ſna[illegible] ſix or eight whitiſh feet; but theſe did not ſeem to ſhine.

OSTRICH, in zoology. See STRUTHIO.

OSTROVIZZA, in Dalmatia (ſee DALMATIA), which ſome would have the ſame as Arauzoua, and others the Stlupi of the ancients, though probably it has no connection with either the one or the other. It was purchaſed in 1420 by the republic of Venice, for 5000 ducats, and ſome pieces of land beſides. Its fortreſs, which was [illegible] on a rock, perpendicularly cut all round, and [illegible] reckoned impregnable before the uſe of artil[illegible] was taken by Soliman in 1524, but ſoon after returned under the dominion of Venice. At preſent, no traces of its fortification remain, and it is only a bare and iſolated maſs. There are ſome natural curioſities about the place.

OSTUNI, a town of Italy, in the kingdom of Naples, and in the Terra di Otranto, with a biſhop's ſee. Its territory is well cultivated, and abounds with olives and almonds. It is ſeated on a mountain near the Gulph of Venice, in E. Long. 17. 49. N. Lat. 49. 59

OSWEGO, a fort of North America, ſeated on the ſouth ſide of the lake Ontario, in W. Long. 70. 35. N. Lat. 45. 15.

OSW[illegible]ZEN, a town of Poland, in the palatinate of Craco[illegible], with the title of a duchy. It carries on a great trade in ſalt, and is ſeated on the river Viſtula. E. Long. 19. 47. N. Lat. 50. 1.

OSWESTRY, in the county of Salop, in England, 172 miles from London, is a very old town, with a caſtle, a wall, and a ditch, and was anciently a borough. It is a place celebrated in Saxon hiſtory and legendary piety. On this ſpot, Auguſt 5. 642, was fought the battle between the Chriſtian Oſwald king of the Northumbrians and the pagan Penda king of the Mercians, in which Oſwald was defeated, and loſt his life. The barbarian victor cut the body of the ſlain prince in pieces, and ſtuck them on ſtakes diſperſed over the field, as [illegible] many trophies; but, according to others, his head and hands only were thus expoſed. A prince ſo dear to the church as Oſwald, and ſo attached to the profeſſors of the monaſtic life, received every poſthumous honour they could beſtow. He was raiſed to the rank of a ſaint, and his ſanctity confirmed by numberleſs miracles, which are too numerous and too trifling to admit of particular deſcription. Its church, which is of no great antiquity, was formerly a monaſtery, and was called Blancminſter. It is, however, ſpacious, and has a handſome plain tower. In the years 1542 and 1567, this town ſuffered much by fire. It is governed by two bailiffs, burgeſſes, &c. and once drove a great trade in Welch cottons and flannels, which is now very much decayed. There is now ſcarce a tolerable houſe for travellers. But beſides a good grammar ſchool, it is noted for an excellent charity-ſchool for 40 boys, beſides girls, which has the beſt methods for exciting the emulation of the children in their learning; for 20 of the boys are ſet to ſtrive againſt 20 others for ſhoes, and the 20 who perform their taſk beſt have ſhoes firſt; then 10 of the boys are ſet againſt 10 others for the like premium, and ſo on till they are all ſhod: ſo in the girls ſchool a ſhift is put up for the beſt ſpinner, a head dreſs for the beſt ſempſtreſs, a pair of ſtockings for the beſt knitter, a Bible for the beſt reader, and a copy-book for the beſt writer. In the wall with which the town was fortified there were four gates. That called the *Block-gate* is demoliſhed; the New-gate, Willow-gate, and the Beatrice-gate, ſtill remain. The laſt is a handſome building, with a guard-room on both ſides. There are only two fragments of the caſtle remaining. It ſtood on an artificial mount, ſurrounded by a foſſe, extending to the Willow-gate.

Oſweſtry, Oſymandes.

OSYMANDES, a famous king of Egypt, was, according to ſome authors, the firſt monarch who collected a great number of books for the purpoſe of forming a library. To this curious collection he gave the title of *Pharmacy of the Soul*. Of all the monuments of the kings of Thebes, that of Oſymandes is one of the moſt magnificent. "He appears (ſays an elegant author) to have been a prince of great elegance and taſte in his day. Diodorus Siculus deſcribes many ſumptuous edifices erected by him; among thoſe edifices his palace or mauſoleum, whichſoever it was, has been eminently diſtinguiſhed for the paintings and ſculptures with which it was adorned. When we look to the ſubjects of thoſe works, we ſhall have reaſon to think that no man in any age could diſcover a fairer and more enlightened judgment than he did in the employment of the genius around him, which was not tamely devoted to dull or contracted objects, nor laviſhed on ſcenes of ſavage life, nor wholly engroſſed in alluſions to himſelf, but ſenſibly enlarged to a variety of contemplation which might become a great ſovereign; and in each of thoſe parts the ſubject was characteriſtically great.

Bromley's Hiſt. of the Fine Arts, vol. 1.

"* In one place was repreſented, in a multitude of ſculptures, his expedition againſt the Bactrians, a people of Aſia, whom he had invaded with 400,000 foot, and 20,000 horſe, and whom he conquered. In another part was diſplayed the variety of fruits and productions, with which Pan, the great ſource of all things, had enriched the fertile land over which Oſymandes reigned. A third group of figures repreſented the monarch himſelf, as the high prieſt of the country, offering to the gods the gold and ſilver which he drew every year from the mines of Egypt. In another part of the edifice was exhibited, in an infinite number of figures, an aſſembly of judges, in the midſt of a great audience attentive to their deciſions; the preſident or chief of thoſe judges, ſurrounded by many books, wore on his breaſt a picture of Truth with her eyes ſhut—thoſe emphatic emblems, beyond which no age could go for the impreſſion of that wiſdom and impartiality which ought to prevail in adminiſtrative juſtice."

* Diod. Sic. l. 1. p. 45. edit Rhodom.

In ſhort, we cannot without aſtoniſhment read the account which Diodorus Siculus gives of the almoſt incredible magnificence of this prince, and of the immenſe ſums which he ſpent upon thoſe grand works.

Amongst a variety of other surprising curiosities, was to be seen a statue in the attitude of sitting, which was the largest in all Egypt, the length of one of the feet being seven cubits. Not only the art of the sculptor, but also the beauty of the stone, which was perfect in its kind, contributed to render this a masterpiece of sculpture. It bore the following inscription: *I am OSYMANDES, king of kings; whoever will dispute with me this title, let him surpass me in any of my works.*

Indeed (to use the words of the same elegant author quoted above) "the palace or mausoleum of this accomplished prince must give us a striking assurance of the progress which had been made in the arts at that time; whether he lived, as some have thought †, the immediate successor of the first Busiris, which was somewhat later than the period of Semiramis; or, as others have conceived ‡, subsequent to Sesostris, which would be 400 years later. Diodorus Siculus, who describes that edifice, says nothing of the age in which Osymandes lived; every opinion, therefore, on that point must be conjecture. We shall only remark, that there is nothing in the works of art in that edifice which should appear too much for the earliest age in which that monarch has been placed, when we look back to what was done of those works in a period full as early by Semiramis in Assyria."

† See Rollin's Anc. Hist.

‡ Marsham, p. 403. Goguet. vol ii. p. 141.

OTACOUSTIC INSTRUMENT, or *Auricular Tube*, an instrument to facilitate the hearing. See ACOUSTICS, n° 25.

OTAHEITEE, a celebrated island of the South sea, situated in W. Long. 149. 13. S. Lat. 17. 46. It was discovered by Captain Wallis in 1767; afterwards Mr Bougainville touched here; and it was visited by Captain Cook in 1773 and 1774, who had in 1769 sailed round the island in a boat to observe the transit of Venus.

1 Appearance of the country.

The island consists of two distinct kingdoms, which are united by a narrow neck of land; the larger being called by the natives *Tiarrabou*, or *O-Taheitee-Nue*; the smaller one *Opoureonou*, or *O-Taheitee-Ete*. The circumference of both islands is about 40 leagues; the larger kingdom being divided into 43 districts. The country has a delightful romantic appearance. The coast, viewed from the sea, presents a most beautiful prospect, being elevated like an amphitheatre. The island is skirted with a reef of rocks, and towards the sea is level, being covered with fruit-trees of various kinds, particularly the cocoa nut. At the distance of about three miles from the shore, the country rises into lofty hills that are covered with wood, and terminate in peaks, from which large rivers are precipitated into the sea. The stones every where appear to have been burnt, not one being found which did not give manifest signs of fire; so that there is great reason for supposing that this and the neighbouring islands are either the shattered remains of a continent, or were torn from rocks, which from the creation of the world have been the bed of the sea, and thrown up in heaps to a height which the waters never reach. What is farther extraordinary, the water does not gradually grow shallow as we approach the shore, but is of immense depth close by the land; and the islands in this neighbourhood are almost everywhere surrounded by reefs which appear to be rude and broken in the manner that some violent concussion would naturally leave the solid substance of the earth; and Mr Forster saw a rock with projecting longitudinal angles of black compact basaltes. The exterior ranges of hills are sometimes entirely barren, and contain a great quantity of yellowish clay, mixed with iron ochre; but others are covered with mould and wood like the mountains in the internal part[illegible] country. Pieces of quartz are sometimes [illegible]; but no indications of precious min[illegible] any kind have been observed, iron only excepted.

2 Climate.

The air is extremely healthy and pleasant; the heat is not troublesome; and fresh meat will keep very well for two days, and fish one day. The winds do not blow constantly from the east, but generally a little breeze from east to south-south-east. The tide rises very little; and, being governed by the winds, is very uncertain. "The climate," says M. Bougainville, "is so healthy, that notwithstanding the hard labour of the ships companies while on shore, though the men were continually in the water, and exposed to the meridian sun, though they slept upon the bare soil, and in the open air, none of them fell sick; those who were afflicted with the scurvy, and were sent on shore, regained their strength: although they were obliged to assist in the erecting of a fort, and had scarce one uninterrupted night, yet they were so far recovered in the short space of time they continued there, that they were afterwards perfectly cured on board."

3 High mountains.

Notwithstanding the great height of the inland mountains of Otaheitee, none of their rocks have the appearance of ba[illegible]ss, every one of them being covered with wo[illegible]. "We hardly believed our eyes," says M. de Bo[illegible]inville, "when we saw a peak covered with woods [illegible] to its highest summit, which rises above the level [illegible] the mountains in the interior parts of the southern quarter of this island. Its apparent size seemed to be more than 30 toises in diameter, and grew less in breadth as it rose higher. At a distance it might have been taken for a pyramid of immense height, which the hand of an able sculptor had adorned with garlands and foliage." One of the mates of the Dolphin, with a party of marines and seamen, penetrated into the interior parts of the island; and having ascended, with great difficulty, a mountain which they supposed to be a mile high, they discovered mountains before them so much higher, that with respect to them they seemed to be in a valley: towards the sea the view was enchanting, the sides of the hills were beautifully clothed with wood, villages were everywhere interspersed; and the valleys between them afforded a still richer prospect; the houses stood thicker, and the verdure was more luxuriant; and Mr Forster, with other gentlemen, ascended to the summit of one of the highest mountains in the island, from whence they had a prospect of the island of Huahine, and some others lying at the distance of 40 leagues; from which we may form some judgment of the prodigious height of that mountain. The view of the fertile plain below them, and of a river making innumerable meanders, was delightful in the highest degree. The vegetation on the upper part of the mountains was luxuriant, and the woods consisted of many unknown sorts of trees and plants.

4 Soil and produce.

The soil of this island is a rich fat earth, of a blackish

ish colour. It produces spontaneously, or with the slightest culture imaginable, a great variety of the most excellent fruits; such as bread-fruit, cocoa-nuts, bananas of 13 sorts, plantains, potatoes, yams, a fruit known here by the name of *jambu*, and reckoned most delicious; sugar-canes, which the inhabitants eat raw; ginger; turmeric; a root of the salep kind, called by the inhabitants *pea*; a [illegible] called *ethee*, of which the root only is eaten; [illegible] grows in a pod like that of a large ki[illegible], by the natives called *abee*; a tree called *wharra*, which produces fruit something like the pine-apple, and which is known in the East Indies by the name of *pandanes*; a shrub called *nono*; the *morinda*, which also produces fruit; a species of fern; a plant called *theve*; and the Chinese paper-mulberry, of the bark of which they make their cloth; an herb which the inhabitants eat raw, its flavour somewhat resembling that of the West India spinage called *calletoon*, but its leaf very different; a plant which the natives call *ava* [illegible], from the root of which they express a liquor, which, if drank to excess, intoxicates like wine or distilled spirits. Here are a sort of shady trees covered with a dark-green foliage, bearing golden-coloured apples, which, in juiciness and flavour, resemble the ananas or pine-apple. One of the most beautiful trees in the world received here the name of *Barringtonia*; it had a great abundance of flowers larger than lilies, and perfectly white, excepting the tips of their numerous chives, which were of a deep crimson. Such a quantity of these flowers were seen dropped off, that the ground underneath the tree was entirely covered with them. The natives called the tree *buddow*; and said, that the fruit, which is a large nut, when bruised and mixed up with some shell-fish, [illegible] thrown into the sea, intoxicates the fish [illegible] some [illegible], so that they come to the surface of the water, and suffer themselves to be taken with people's hands. Several other maritime plants in tropical climates are found to have the same quality. Mr Dalrymple describes the method of catching fish with these plants as follows: the plant is thrust under the coral rocks or hollows where the fish haunt; the effect is most sensible in still water, though it is effectual in the open sea; for the same gentleman says, he has seen fish soon after float on the surface of the water half dead, and some totally without life; and where the effect is less violent, the fish will be seen under the water to have lost their poise, without coming up to the surface. Fish caught in this manner are not in the least noxious or ill tasted.

5 Animals. In this island they have domestic poultry exactly resembling those of Europe: besides which there are wild ducks; also beautiful green turtle doves; large pigeons of a deep blue plumage and excellent taste; a small sort of paroquets, very singular on account of the various mixture of red and blue in their feathers; also another sort of a greenish colour, with a few red spots; the latter are frequently tamed, and are valued on account of their red feathers. Here is a king-fisher of a dark green, with a collar of the same hue round his white throat; a large cuckoo, and a blue heron. Small birds of various kinds dwell in the shady trees; and, contrary to the generally received opinion that birds in warm climates are not remarkable for their song, have a very agreeable note. There were no quadrupeds but dogs, hogs, and rats; and for these last the natives were said to have a scrupulous regard, insomuch that they would by no means kill them; however, Captain Cook, in 1773, turned about 14 cats on the island, which have probably reduced the number of these vermin. No frogs, toads, scorpions, centipedes, or any kind of serpent, have been found here; the ants, however are troublesome, but not very numerous. When the Endeavour first arrived here in 1769, the flies were found excessively troublesome; but musquetto nets and fly-flaps in some measure removed the inconvenience. Sydney Parkinson, in his journal, says, that notwithstanding these flies are so great a nuisance, the natives, from a religious principle, will not kill them. But there is a strange disagreement in the accounts of different voyagers concerning this matter. For M. Bougainville says, "this island is not infested with these myriads of troublesome insects that are the plague of other tropical countries." And Mr Forster says, "not a gnat or musquetto hummed unpleasantly about us, or made us apprehensive of its bite." This inconvenience must therefore be felt at certain seasons of the year, and in certain districts of the country, more sensibly than at other times and places. There is great variety of excellent fish; and according to Aitourou, a native who embarked with M. de Bougainville, there are sea snakes on the shore of Otaheitee, whose bite is mortal.

6 Description of the inhabitants, &c. The inhabitants of Otaheitee are a stout, well made, active, and comely people. The stature of the men, in general, is from five feet seven to five feet ten inches; the tallest man seen by Captain Wallis measured six feet three inches and a half; and Captain Cook, in his second voyage, describes O-Too, the king of Otaheitee, to be of that height. "In order to paint an Hercules or a Mars," says M. de Bougainville, "one could nowhere find such beautiful models." They are of a pale brown complexion; in general their hair is black, and finely frizzled; they have black eyes, flat noses, large mouths, and fine white teeth; the men wear their beard in many fashions, all of them plucking out a great part, and have prominent bellies. Most of them smell strong of the cocoa nut oil. The women in general are much smaller, especially those of the lower rank or tawtows, which is attributed to their early and promiscuous intercourse with the men; whilst the better sort, who do not gratify their passions in the same unbridled manner, are above the middle stature of Europeans. Their skin is most delicately smooth and soft: they have no colour in their cheeks; their nose is generally somewhat flat, but their eyes are full of expression, and their teeth beautifully even and white. "The women," says M. de Bougainville, "have features not less agreeable than the generality of Europeans, and a symmetry of body and beautiful proportion of limbs which might vie with any of them. The complexion of the men is tawny; but those who go upon the water are much more red than those who live on shore. Some have their hair brown, red, or flaxen, in which they are exceptions to all the natives of Asia, Africa, and America, who have their hair black universally; here, in the children of both sexes, it is generally flaxen. The strongest expression is painted in the countenances of these people; their walk is graceful, and all their motions are

Otaheitee. performed with great vigour and eaſe." "I never beheld ſtatelier men, (ſays Sydney Parkinſon.) The men of conſequence on the iſland wear the nails of their fingers long, which they conſider as a very honourable badge of diſtinction, ſince only ſuch people as have no occaſion to work can ſuffer them to grow to that length. This cuſtom they have in common with the Chineſe; but the nail of the middle finger on the right hand is always kept ſhort, the meaning for which peculiarity could not be learned. Only one ſingle cripple was met with among them, and he appeared to have been maimed by a fall. The women always cut their hair ſhort round their heads. Both ſexes have a cuſtom of ſtaining their bodies, which they call *tattowing*; both men and women have the hinder part of their thighs and loins marked very thick with black lines in various forms; theſe marks are made by ſtriking the teeth of an inſtrument ſomewhat like a comb juſt through the ſkin, and rubbing into the punctures a kind of paſte made of ſoot and oil, which leaves an indelible ſtain. The boys and girls under twelve years of age are not marked; a few of the men, whoſe legs were marked in chequers by the ſame method, appeared to be perſons of ſuperior rank and authority. Mr Banks ſaw the operation of tattowing performed upon the backſide of a girl about thirteen years old. The inſtrument uſed upon this occaſion had thirty teeth; and every ſtroke, of which at leaſt a hundred were made in a minute, drew an ichor or ſerum a little tinged with blood. The girl bore it with moſt ſtoical reſolution for about a quarter of an hour; but the pain of ſo many hundred punctures as ſhe had received in that time, then became intolerable. She firſt complained in murmurs, then wept, and at laſt burſt into loud lamentations, earneſtly imploring the operator to deſiſt. He was, however, inexorable; and when ſhe began to ſtruggle, ſhe was held down by two women, who ſometimes ſoothed and ſometimes chid her; and now and then, when ſhe was moſt unruly, gave her a ſmart blow. Mr Banks ſtaid in a neighbouring houſe an hour, and the operation was not over when he went away; yet it was performed but upon one ſide, the other having been done ſome time before; and the arches upon the loins, in which they moſt pride themſelves, and which gave more pain than all the reſt, were ſtill to be done. Both men and women are not only decently but gracefully clothed, in a kind of white cloth that is made of the bark of a ſhrub, and very much reſembles coarſe China paper. Their dreſs conſiſts of two pieces of this cloth; one of them, having a hole made in the middle to put the head through, hangs from the ſhoulders to the mid-leg before and behind; another piece, which is between four and five yards long, and about one yard broad, they wrap round the body in a very eaſy manner: This cloth is not woven; but is made like paper, of the macerated fibres of the inner bark ſpread out and beaten together. Their ornaments are feathers, flowers, pieces of ſhell, and pearls; the pearls are worn chiefly by the women. In wet weather they wear matting of different kinds, as their cloth will not bear wetting. The dreſs of the better ſort of women conſiſts of three or four pieces: one piece, about two yards wide and eleven long, they wrap ſeveral times round their waiſt, ſo as to hang down like a petticoat as low as the middle of the leg; and this they call *parou*. This ſimple drapery affords the ſex an opportunity of diſplaying an elegant figure to the greateſt advantage, according to the talents and taſte of the wearer: no general faſhions force them to diſfigure inſtead of adorning themſelves, but an innate gracefulneſs is the companion of ſimplicity. [illegible] cloth they give a very ſtrong perfume.

7 Of their houſes. The chief uſe w[illegible] of their houſes is to ſleep in them; for unleſs it [illegible]ey eat in the open air under the ſhade of a tree. Their houſes are no other than ſheds, all built in the wood between the ſea and the mountains; they are erected on an oblong ſquare; their width is nearly half of their length; they are nothing more than a roof, not quite four feet from the ground, raiſed on three rows of pillars, one row on each ſide, and one in the middle. The roof reſembles our thatched houſes in England, and conſiſts of two flat ſides inclining to each other. Their thatch conſiſts of palm-leaves. The flower of their dwelling is covered with hay, over which they ſpread mats. Some of theſe erections are furniſhed with a ſtool, which is appropriated ſolely to the uſe of the maſter of the family: they conſiſt of no other furniture except a few blocks of wood, which being ſquare, one ſide is hollowed into a curve; and theſe they uſe as pillows, and with their apparel they cover themſelves. In theſe open dwellings the whole family repoſe themſelves at night. The ſize of the houſe is proportioned to the number that conſtitutes the family. The eſtabliſhed order in theſe dormitories is, for the maſter and his wife to ſleep in the middle; round them the married people; in the next circle the unmarried women; and in the next, at the ſame diſtance, the unmarried men; and the ſervants at the extremity of the ſhed; but in fair weather the latter ſleep in the open air. Some few dwellings, however, conſtructed for greater privacy, are entirely incloſed with walls of reeds, connected together with tranſverſe pieces of wood, ſo as to appear ſomewhat like large bird cages cloſely lined; in theſe houſes there is commonly a hole left for the entrance, which can be cloſed up with a board.

Their candles are made of the kernels of a kind of oily nut, which they ſtick one above another on a ſkewer that is thruſt through the middle of them; the upper one being lighted burns to the ſecond, at the ſame time conſuming that part of the ſkewer that goes through it; the ſecond taking fire burns in the ſame manner down to the third, and ſo to the laſt; they burn a conſiderable time, and afford a pretty good light. The natives generally retire to reſt about an hour after it is dark.

8 Food, method of cookery. The food of the common people entirely conſiſts of vegetables. Theſe are, the bread-fruit, with bananas, plantains, yams, apples, and a ſour fruit, which, though not pleaſant by itſelf, gives an agreeable reliſh to roaſted bread-fruit, with which it is frequently beaten up: (See the article *Bread Tree*). The fleſh, which is reſerved for the tables of the great, is either poultry, hogs, or dogs, the fleſh of their fowls is not well-taſted, but that of dogs is eſteemed by the natives beyond pork. The ſmaller fiſh are generally eaten raw, as we eat oyſters: every thing that can be procured from the ſea is made an article of their food; for they will eat not only ſea-inſects, but what the ſeamen call *blubbers*,

Otaheitee. *blubbers*, though ſome of them are ſo tough that they are obliged to ſuffer them to become putrid before they can be chewed. A very large ſhark being caught by the Dolphin's people was given to the natives; who ſoon cut it to pieces, and carried it away with great ſatisfaction.

They kill the animals they intend for food by ſuffocating them, which is done by ſtopping the mouth and noſe with their hands; they then ſinge off the hair, by holding the animal over a fire, and ſcraping him with a ſhell: with this inſtrument they cut him up, and take out the entrails; which are waſhed, and put into cocoa-nut ſhells, together with the blood. Dogs are eaten that are fed wholly upon bread-fruit, cocoa-nuts, yams, and other vegetables, and are never ſuffered to taſte any animal food; and thoſe who have taſted the fleſh of a dog thus fed, have declared it to be little inferior to Engliſh lamb. In order to dreſs their food, they kindle a fire, by rubbing the end of one piece of dry wood upon the ſide of another, in the manner as a carpenter with us whets a chiſel. They then dig a pit about half a foot deep, and two or three yards in circumference; they pave the bottom with large pebble ſtones, which they lay down very ſmooth and even, and then kindle a fire in it with dry wood, leaves, and the huſks of cocoa-nuts. When the ſtones are ſufficiently heated, they take out the embers, and rake up the aſhes on every ſide; they then cover the ſtones with a layer of green cocoa-nut leaves, and wrap up the animal that is to be dreſſed in the leaves of the plantain. If it is a ſmall hog, they wrap it up whole; if a large one, they ſplit it. When it is placed in the pit, they cover it with the hot embers, and lay upon them bread-fruit and yams, which are alſo wrapped up in the leaves of plantain. Over theſe they ſpread the remainder of the embers, mixing among them ſome of the hot ſtones, with more cocoa-nut tree leaves upon them, and then cloſe up all with earth, ſo that the heat is kept in; the oven is kept thus cloſed a longer or ſhorter time according to the ſize of the meat that is dreſſed. The meat, when taken out, is ſaid to be better dreſſed than any other way. They uſe ſhells for knives; and carve very dexterouſly with them, always cutting from themſelves. One of the principal attendants on Oberea, attempting the uſe of the knife and fork, could not feed himſelf therewith; but by the mere force of habit, his hand came to his mouth, and the victuals at the end of his fork went away to his ear.

They are quite unacquainted with the method of boiling water, as they leave no veſſels among them that will bear the fire. Whilſt the noble Oberea was one morning at breakfaſt with Captain Wallis on board the Dolphin, the ſurgeon filled the tea-pot by turning the cock of a vaſe that ſtood upon the table. One of the lady's attendants obſerved this practice very attentively, and ſoon after, turning the cock himſelf, received the water upon his hand; he no ſooner felt himſelf ſcalded, than he roared and danced about in an extravagant manner. The other Indians, unappriſed of the cauſe of theſe emotions, ſtood gazing at him in amazement, and not without ſome mixture of terror: but the gentlemen in company, who ſoon perceived the cauſe of the outcry, diſpelled the apprehenſions of their viſitants; and ſome ointment being applied to the ſcald, good humour and confidence were again reſtored. The gunner of the ſhip, who was appointed comptroller of the market which was eſtabliſhed on ſhore with the natives, uſed to dine on the ſpot; the aſtoniſhment of theſe people was very great to ſee him dreſs his pork and poultry in a pot; at length an old man, who was extremely ſerviceable in bringing down proviſions to be exchanged, was put into poſſeſſion of an iron pot, and from that time he and his friends ate boiled meat every day. Several iron pots were likewiſe given to Oberea and ſome of the chiefs; which were in conſtant uſe, and drew every body to ſee them; but although the particulars of two ſucceſſive voyages of Captain Cook to this iſland are circumſtantially related, we hear no more of this improvement in the culinary art, or of the further aſſiſtance which has been rendered thoſe people in ſupplying them with pots for boiling; but however deſirous the natives might be to eat boiled meat, it was not adviſable to have ſuch an article of barter as iron kettles, when a few ſpike nails, or a common hatchet, would procure one of their largeſt hogs. Otaheitee.

Salt water is the uſual ſauce to their food; thoſe who live near the ſea have it furniſhed as it is wanted, others at a diſtance keep it in large bamboos. The kernels of the cocoa-nuts furniſh them with another ſauce: theſe, made into a paſte ſomething of the conſiſtence of butter, are beat up with ſalt water, which has a very ſtrong flavour; but though at firſt it ſeemed very nauſeous, yet when the taſte became familiar, it was much reliſhed.

Their general drink is water, or the milk of the cocoa-nut. They ſhowed in general an averſion to ſtrong liquors; and whenever any one of them happened to drink ſo freely with any of the ſhip's company as to be intoxicated, he reſolutely refuſed to taſte any thing that was likely to produce the ſame effect again; but they have a plant which they call *ava*, from the root of which they procure a liquor which has an inebriating quality. Their manner of preparing this ſtrong drink is as ſimple as it is diſguſting to an European. Several of the people take ſome of the root, and chew it till it is ſoft and pulpy; they then ſpit it out into a platter or other veſſel, every one into the ſame: into this general receptacle water is poured according to the quantity prepared. The juice thus diluted is ſtrained through ſome fibrous ſtuff like fine ſhavings, after which it is fit for drinking, and it is always prepared for preſent uſe: it has a pepperiſh taſte; drinks flat, and rather inſipid; and though it intoxicates, yet Captain Cook ſaw but one inſtance where it had that effect, as the natives generally drink it with great moderation, and but little at a time. Sometimes they chew this root as Europeans do tobacco, and ſometimes they will eat it wholly.

They eat alone, or at leaſt only in company with a gueſt that happens to call in; and the men and women never ſit down together to a meal: the ſhade of a ſpreading tree ſerves them for a parlour; broad leaves ſpread in great abundance ſerve for a table cloth; and if a perſon of rank, he is attended by a number of ſervants who ſeat themſelves round him: before he begins his meal, he waſhes his mouth and hands very clean, and repeats this ſeveral times whilſt he is eating. The

quantity

quantity of food which these people eat at a meal is prodigious. Captain Cook says, he has seen one man devour two or three fishes as big as a pearch; three bread-fruits, each bigger than two fists; 14 or 15 plantains, or bananas, each six or seven inches long and four or five round, and near a quart of the pounded bread-fruit. Men of rank are constantly fed by their women; and one of the chiefs who dined on board the ships in 1769, showed such reluctance to feed himself, that one of the servants was obliged to feed him to prevent his returning without his meal. In one of the excursions which the gentlemen of the ships made into the country in 1773, they arrived at a neat house, where a very fat man, who seemed to be a chief of the district, was lolling on his wooden pillow; before him two servants were preparing his desert, by beating up with water some bread-fruit and bananas in a large wooden bowl, and mixing with it a quantity of fermented sour paste called *mahie*. While this was doing, woman, who sat down near him, crammed down his throat by handfuls the remains of a large baked fish, and several bread-fruits, which he swallowed with a voracious appetite: his countenance was the picture of phlegmatic insensibility, and seemed to testify that all his thoughts centered in the gratification of his appetite. He scarce deigned to look at the strangers; and a few monosyllables which he uttered, were extorted from him to remind his feeders of their duty, when by gazing at them they grew less attentive to him.

That these people, who are remarkably fond of society, and particularly that of their women, should exclude its pleasures from the table, where, among all other nations, whether civil or savage, they have been principally enjoyed, is truly inexplicable. How a meal, which everywhere else brings families and friends together, comes to separate them here, was a singularity much inquired about, but never accounted for. "They ate alone (they said), because it was right;" but why it was right to eat alone, they never attempted to explain. Such, however, was the force of habit in this instance, as it is in every other, that they expressed the strongest dislike, and even disgust, at their visitants eating in society, especially with women, and of the same victuals. "At first (says Captain Cook) we thought this strange singularity arose from some superstitious opinion; but they constantly affirmed the contrary. We observed also some caprices in the custom, for which we could as little account as the custom itself. We could never prevail with any of the women to partake of the victuals at our table, when we were dining in company; yet they would go five or six together into the servants apartments, and there eat very heartily of whatever they could find: nor were they in the least disconcerted if we came in while they were doing it. When any of us have been alone with a woman, she has sometimes eaten in our company; but then she has expressed the great unwillingness that it should be known, and always extorted the strongest promises of secrecy. Among themselves, even two brothers and two sisters have each their separate baskets of provisions, and the apparatus of their meal. When they first visited us at our tents, each brought his basket with him; and when we sat down to table, they would go out, sit down upon the ground, at two or three yards distance from each other, and turning their faces different ways take their repast without exchanging a single word. The women not only abstain from eating with the men, and of the same victuals, but even have their victuals separately prepared by boys kept for that purpose, who deposit it in a separate shed, and attend them with it at their meals. But though they would not eat with us, or with each other, they have oft[illegible] us to eat with them, when we have visit[illegible] whom we were particularly acquainted [illegible] their ho[illegible] and we have often upon such occasions eaten out [illegible] the same basket, and drank out of the same cup. The elder women, however, always appeared offended at this liberty; and if we happened to touch their victuals, or even the basket that contained it, they would throw it away.

After meals, and in the heat of the day, the middle-aged people of the better sort generally sleep. They are indeed extremely indolent; and sleeping and eating are almost all that they do. Those that are older are less drowsy, and the boys and girls are kept awake by the natural activity and sprightliness of their age.

These islanders, who inhabit huts exposed to all the winds, and hardly cover the earth, which serves them for a bed, with a layer of leaves, are remarkably healthy and vigorous, and live to an old age without enduring any of its infirmities; their senses are acute, and they retain their beautiful teeth to the last. M. de Bougainville describes an old man, whom they saw on their landing, who had no other character of old age, than that respectable one which is imprinted on a fine figure. His head was adorned with white hair, and a long white beard; all his body was nervous and fleshy; he had neither wrinkles, nor showed any other tokens of decrepitude. This venerable man seemed displeased at the arrival of these strangers; he even retired without making any returns to the courtesies they paid to him; but he gave no signs either of fear, astonishment, or curiosity: very far from taking any part in the raptures which the multitude expressed, his thoughtful and suspicious air seemed to indicate, that he feared the arrival of a new race of men would interrupt the happiness he had so long enjoyed. From whence it may be inferred, that his mind was not a whit more impaired than his body. There are, however, several sorts of leprous complaints on this island, which appear in cutaneous eruptions of the scaly kind; some were seen that had ulcers upon different parts of their bodies: yet they seemed little regarded by those who were afflicted with them, and no application whatever was used to them, not so much as to keep off the flies. But instances of them are rare, as the excellency of their climate, and the simplicity of their vegetable food, prevent almost all dangerous and deadly disorders. They are sometimes afflicted with the cholic, and coughs are not unknown among them; and the chiefs, who fare more sumptuously, as a punishment for their voluptuousness are sometimes attacked with a disorder similar to the gout, in which the legs are swelled and excessively painful. M. de Bougainville's surgeon assured him, that he had seen many with marks of the small-pox.

The usual method employed here to restore the sick to health, is by pronouncing a set form of words; after which

Otaheitee. which the exorcist applies the leaves of the cocoa-tree plaited to the fingers and toes of the sick; so that nature is left to conflict with the disease, without being assisted with any salutary application of art. But tho' they seem utterly destitute of medical knowledge, they appear to be no inconsiderable proficients in surgery, which they had an opportunity of proving while the Dolphin lay here. One of the seamen, when on shore, ran a large splinter into his foot; and the surgeon not being at hand, one of his comrades endeavoured to take it out with a pen-knife: but after putting the poor fellow to a great deal of pain, he was obliged to give it over: an old native, who had been very active and successful in establishing a good understanding between the ship's company and his countrymen, happening to be present, called a man from the other side of the river, who having examined the lacerated foot, fetched a shell from the beach, which he broke to a point with his teeth; with which instrument he laid open the wound, and extracted the splinter. Whilst this operation was performing, the old man went a little way into the wood, and returned with some gum, which he applied to the wound upon a piece of the cloth that was wrapped round him, and in two days time it was perfectly healed. This gum was produced by the apple-tree; the surgeon of the ship procured some of it, and used it as a vulnerary balsam with great success. Captain Cook, in 1769, saw many of the natives with dreadful scars; one man, in particular, whose face was almost entirely destroyed; his nose, including bone, was perfectly flat; and one cheek and one eye were so beaten in, that the hollow would almost receive a man's fist; yet no one ulcer remained.

The venereal disease is said to have been entailed upon these people by the crew of M. de Bougainville's ships, who visited this island a short time after Captain Wallis had left it. In 1769, more than one-half of the crew in Captain Cook's ship had contracted it, during a month's stay here. The natives distinguished it by a name of the same import with rottenness, but of a more extensive signification. They described, in the most pathetic terms, the sufferings which the first victims to its rage endured; and told him that it caused the hair and the nails to fall off, and the flesh to rot from the bones; that it spread an universal terror and consternation among the inhabitants, so that the sick were abandoned by their nearest relations, lest the calamity should spread by contagion, and were left to perish alone in such misery as till then had never been known among them. But there seems to be some reason to hope that they had found out a specific cure for it, as none were seen on whom it had made a great progress; and one who went from the ship infected, returned, after a short time, in perfect health. Both Captain Cook and Mr Forster, in their relations of their voyage in the Resolution, endeavour to establish the opinion, that this scourge of licentiousness was felt in the South Sea islands previous to any of the modern voyages that have been made thither, and that it was an indigenous disease there. But if that conclusion is well founded, how comes it, that at all the places where the Resolution touched in 1773, which had before been visited by the Endeavour in 1769, such as New Zealand for instance, the crew, more or less, became infected by their commerce with the women, and not at all so at places which they visited, for the first time, in the Resolution?

Manufactures. 10 The principal manufactures among the Otaheiteans is their cloth. This is made of the bark of trees, which are of three kinds, *viz.* the Chinese mulberry-tree, or *aouta;* the bread-fruit tree, or *ooroo;* and one that is described by Dr Hawkesworth as resembling the wild fig tree of the West Indies. Of all these the paper mulberry affords the best cloth; what is made from that being both finer, softer, whiter, and better suited to take a colour; the *ooroo* produces cloth much inferior in contexture; and the last is very coarse, in colour resembling the darkest brown paper; but this last is the only kind that withstands water: (See the article BARK.)—They likewise prepare a red dye; which is made by mixing the yellow juice of a small species of fig, which the natives call *mattee,* with the greenish juice of a sort of fern or bindweed, or of several other plants, which produce a bright crimson: and this the women rub with their hands, if the piece is to be uniformly of a colour; or they make use of a bamboo reed if the piece is to be marked or sprinkled into different patterns. The colour fades very soon, and becomes of a dirty red; but notwithstanding this defect, and its being liable to be spoiled by rain, the cloth thus stained is highly valued, and is worn only by the principal inhabitants of the country. The inhabitants perfume their clothes with certain plants; concerning which, Mr Forster made all possible inquiry. Tahea, a friendly native, showed him several plants which are sometimes used as substitutes; but the most precious sort, he either could not, or would not, point out: and from the account of Omai it appears that there are no less than 14 different sorts of plants employed for this purpose.

Matting is another Otaheitean manufacture: and in this they are so dexterous, that they produce finer mats than any made in Europe. Rushes, grass, the bark of trees, and the leaves of a plant called *wharrou,* are the materials which they work up for this purpose. Their matting is applied to various uses: the coarser kind is employed for sleeping on in the night, or sitting on through the day; the finer sort is converted into garments in rainy weather, their cloth being soon penetrated by wet. They are very dexterous in making basket and wicker-work: their baskets are of a vast number of different patterns, many of them exceedingly neat; and the making them is an art practised by every one, both men and women.

Instead of hemp, they make ropes and lines of the bark of a tree; and thus they are provided with fishing nets; the fibres of the cocoa-nut furnish them with thread, with which they fasten the different parts of their canoes, &c. The bark of a nettle which grows in the mountains, and is called *orawa,* supplies them with excellent fishing lines, capable of holding any kind of fish; and their hooks are made of mother-of-pearl, to which they fix a tuft of hair, made to resemble the tail of a fish. Instead of making them bearded, the point is turned inwards. They make also a kind of seine of a coarse broad grass, the blades of which are like flags. These they twist and tie together in a loose manner, till the net, which is about as wide as a large sack, is from 60 to 80 fathoms long.

Otaheitee. This they haul in smooth shoal water; and its own weight keeps it so close to the ground, that scarcely a single fish can escape. They make harpoons of cane, and point them with hard wood; with which they can strike fish more effectually than an European can with one headed with iron.

11 Working tools. The tools used by the Otaheiteans for all their purposes are, an adze made of stone; a chisel or gouge made of bone, generally the bone of a man's arm between the wrist and elbow; a rasp of coral, and the skin of a sting-ray; also coral and sand, as a file or polisher: and with these they fell timber, cleave and polish it, and hew stone. The stone which makes the blade of their adzes is a kind of basaltes, of a grey or blackish colour, not very hard, but of considerable toughness; they are formed of different sizes; some that are intended for felling, weigh from six to eight pounds; others that are used for carving, not more than as many ounces: but it is necessary to sharpen these rude tools almost every minute; for which purpose a cocoa-nut shell full of water and a stone are always at hand. With such tools they generally take up several days in felling a tree; but after it is down, and split into planks, they smooth them very dexterously and expeditiously with their adzes, and can take off a thin coat from a whole plank without missing a stroke.

12 Weapons. Their weapons are slings, which they use with great dexterity; pikes headed with the skins of sting-rays; and clubs of about six or seven feet long, made of a very hard wood. Thus armed, they are said to fight with great obstinacy; and to give no quarter to man, woman, or child, who happens to fall into their hands during the battle, nor for some time afterwards, till their passion subsides. They have likewise bows and arrows; but the arrows are good for nothing except to bring down a bird, being headed only with stone, and none of them pointed. They have targets of a semicircular form, made of wicker-work, and plaited strings of the cocoa-nut fibres, covered with glossy, bluish-green feathers belonging to a kind of pigeon, and ornamented with many shark's-teeth, arranged in three concentric circles.

13 Canoes. Their boats or canoes are of three different sorts. Some are made out of a single tree, and hold from two to six men. These are principally employed in fishing: the others are constructed of planks very dexterously sewed together; they are of different sizes, and will hold from 10 to 40 men: they generally lash two of these together, and set up two masts between them; or if they are single, they have an outrigger on one side, and only one mast in the middle: and in these vessels they will sail far beyond the sight of land. The third sort seems to be principally designed for pleasure or shew. These are very large, but have no sail; and in shape resemble the gondolas of Venice. The middle is covered with a large awning; and some of the people sit upon it, and some under it. The plank of which these vessels are constructed, is made by spliting a tree, with the grain, into as many thin pieces as possible. The boards are brought to the thickness of about an inch, and are afterwards fitted to the boat with the same exactness that might be expected from an expert joiner. To fasten these planks together, holes are bored with a piece of bone, fixed into a stick for that purpose. Through these holes a Otaheitee. kind of plaited cordage is passed, so as to hold the planks strongly together. The seams are caulked with dry rushes; and the whole outside of the vessel is painted over with a kind of gummy juice, which supplies the place of pitch.

The Otaheiteans are a very industrious people, and 14 Character, manners, &c. friendly in their dispositions, but like all other nations not fully civilized, their passions are extremely violent, and they are very fickle. The manner of singling out a man here for a chosen friend is by taking off a part of your clothing and putting it upon him. Their usual manner of expressing their respect to strangers, or their superiors, at a first meeting, is by uncovering themselves to the middle. They have a custom of saluting those who sneeze, by saying *evaroeia-t-eatoua*, "May the good eatoua awaken you," or "May not the evil eatoua lull you asleep!"

Their propensity to theft is very great, insomuch, that M. Bougainville says, "even in Europe itself one cannot see more expert filchers than the people of this country;" and indeed, in all the voyages made by Captain Cook and others, they had abundant experience of this disposition of the natives, which often produced quarrels, and sometimes even fatal effects. In their behaviour they are extremely lascivious, almost beyond credibility. A woman of distinction who visited Mr Banks used the following ceremony on her first approach to the stranger. After laying down several young plantain-leaves, a man brought a large bundle of cloth; which having opened, he spread it piece by piece on the ground, in the space between Mr Banks and his visitants. There were in all nine pieces: having spread three pieces one upon another, the lady came forward, and, stepping upon them, took up her garments all around her to her waist; she then turned three times round, after which she dropped the veil: when other three pieces were spread, she practised the same ceremony; and so the third time, when the last three pieces were laid out; after which the cloth was again rolled up, and delivered to Mr Banks as a present from the lady, who with her attending friend came up and saluted him. From the unbridled licentiousness of these people, the French gave this island the name of the *New Cythera*. Nay, to such a degree do they carry their libidinous excesses, that a number of t[illegible]cipal people, it is related, have formed themselves into a society, in which every woman is common to every man. This society is distinguished by the name of [illegible], the members of which have meetings from which all others are excluded. At these meetings the passions are excited by a studied course of sensuality, and the coarsest and most brutal pleasures are enjoyed by the whole company. If, however, notwithstanding these excesses, any of the female members of this community should prove with child, unless she can procure some man to adopt the child as his own, not all the strong affections of a mother, if such are not entirely eradicated by a course of life subversive of the feelings as well as the modesty of nature, can save the life of the precondemned innocent; but the child as soon as born is smothered, and the mother is left at liberty to renew her former course of execrable prostitution. Should any man be found to cooperate with a woman in saving the life of a child, they are

Otaheite.

are both excluded for ever from the *arreoy*, and are considered as man and wife. The woman from that time is distinguished by the term *whannow-now*, "the bearer of children;" which in this part of the world only is considered as a term of reproach; and so depraved are those people, that being a member of such a society is boasted of as being a privilege, instead of being stigmatized as t' [illegible] crime. The arreoys enjoy several privile[illegible] greatly respected throughout the Society Islands, as well as at Otaheitee; nay, they claim a great share of honour from the circumstance of being childless. Tupia, one of the most intelligent natives, when he heard that the king of England had a numerous offspring, declared that he thought himself much greater, because he belonged to the arreoys. That this society indulge themselves in promiscuous embraces, and that every woman is common to every man, is contradicted by Mr Forster. He says, that these arreoys choose their wives and mistresses from among the prostitutes; and from this circumstance, as well as their extreme voluptuousness, they have seldom any reason to dread the intrusion of children. He had the following circumstances related to him by Omi or Omiah, one of the natives, who was brought to England. He said, that the pre-eminence and advantages which a man enjoyed as arreoy were so valuable as to urge him against his own feelings to destroy his child; that the mother was never willing to consent to the murder; but that her husband and other arreoys persuaded her to yield up the child; and that where entreaties were not sufficient, force was sometimes made use of. But, above all, he added, that this action was always perpetrated in secret; insomuch, that not even the *totoos* or attendants of the house were present; because, if it were seen, the murderers would be put to death.

Both men and women constantly wash their whole bodies three times a-day in running water, and are remarkably cleanly in their clothes. They are most expert swimmers, being accustomed to the water from their infancy. Captain Cook relates the following remarkable instance of their expertness. On a part of the shore where a tremendously high surf broke, inso-[illegible] could live in it, and the [illegible] near them, they dived under it, and rose again on the other side. The stern of an old canoe added much to their sport. This they took out before them, and swam with it as far as the outermost breach; when two or three getting into it, and turning the square end to the breaking wave, were driven in towards the shore with incredible rapidity, sometimes almost to the beach; but generally the wave broke over them before they got half way; in which case they dived, and rose to the other side with the canoe in their hands, and swimming out with it again, were again driven back. This amazing expertness drew the Captain's attention for more than half an hour; during which time none of the swimmers attempted to come ashore, but seemed to enjoy the sport in the highest degree. At another time, one of the officers of the quarter-deck intending to drop a bead into a canoe for a little boy of six years of age, it accidentally missed the boat, and fell into the sea; but the child immediately leaped overboard, dived after it, and recovered it. To reward him for this feat, some more beads were dropped to him; which excited a number of men and women to amuse the officers with their amazing feats of agility in the water, and not only fetched up several beads scattered at once, but likewise large nails, which, from their weight, descended quickly to a considerable depth. Some of these people continued a considerable time under water; and the velocity with which they were seen to go down, the water being extremely clear, was very surprising. Here a green branch of a tree is used as an emblem of peace, in exact conformity to the custom of the ancient nations. We shall add an extract here from Captain Cook's last voyage to the Pacific Ocean.

"Nothing could make a stronger impression at first sight, on our arrival here, than the remarkable contrast between the robust make and dark colour of the people of Tongataboo *, and a sort of delicacy and whiteness which distinguish the inhabitants of Otaheitee. It was even some time before that difference could preponderate in favour of the Otaheiteans; and then only, perhaps, because we became accustomed to them, the marks which had recommended the others began to be forgotten. Their women, however, struck us as superior in every respect; and as possessing all those delicate characteristics which distinguish them from the other sex in many countries. The beard which the men here wear long, and the hair, which is not cut so short as is the fashion at Tongataboo, made also a great difference; and we could not help thinking that on every occasion they showed a greater degree of timidity and fickleness. The muscular appearance, so common amongst the Friendly Islanders, and which seems a consequence of their being accustomed to much action, is lost here, where the superior fertility of their country enables the inhabitants to lead a more indolent life; and its place is supplied by a plumpness and smoothness of the skin; which though perhaps more consonant with our ideas of beauty, is no real advantage, as it seems attended with a kind of languor in all their motions, not observable in the others. This observation is fully verified in their [illegible] which may be called littl[illegible]

"Personal endowments being in great esteem amongst them, they have recourse to several methods of improving them, according to their notions of beauty. In particular, it is a practice, especially amongst the *Arreoy*, or unmarried men of some consequence, to undergo a kind of physical operation, to render them fair. This is done by remaining a month or two in the house; during which time they wear a great quantity of clothes, eat nothing but bread fruit, to which they ascribe a remarkable property in whitening them. They also speak, as if their corpulence and colour, at other times, depended upon their food; as they are obliged, from the change of seasons, to use different sorts at different times.

"The graceful air and firm step with which these people walk are not the least obvious proof of their personal accomplishments. They consider this as a thing

* One of the Friendly Islands.

Otaheitee.

thing ſo natural, or ſo neceſſary to be acquired, that nothing uſed to excite their laughter ſooner, than to ſee us frequently ſtumbling upon the roots of trees, or other inequalities of the ground.

"Their countenances very remarkably expreſs the abundant mildneſs or good nature which they poſſeſs, and are entirely free from that ſavage keenneſs which marks nations in a barbarous ſtate. One would, indeed, be apt to fancy that they had been bred up under the ſevereſt reſtrictions to acquire an aſpect ſo ſettled, and ſuch a command of their paſſions, as well as ſteadineſs in conduct. But they are at the ſame time frank, cheerful, and good-humoured, though ſometimes, in the preſence of their chiefs, they put on a degree of gravity, and ſuch a ſerious air, as becomes ſtiff and aukward, and has an appearance of reſerve

Their peaceable diſpoſition is ſufficiently evinced from the friendly reception all ſtrangers have met with who have viſited them. Inſtead of offering to attack them openly or clandeſtinely, as has been the caſe with moſt of the inhabitants of theſe ſeas, they have never appeared in the ſmalleſt degree hoſtile, but on the contrary, like the moſt civized people, have courted an intercourſe with their viſitors by bartering, which is the only medium that unites all nations in a ſort of friendſhip. They underſtand barter (which they call *fukkatou*) ſo perfectly, that at firſt we imagined they might have acquired the knowledge of it by commercial intercourſe with the neighbouring iſlands; but we were afterwards aſſured, that they had little or no traffic except with Feejee, from which they get the red feathers, and ſome few other articles which they eſteem. Perhaps no nation in the world traffic with more honeſty, and leſs diſtruſt. We could always ſafely permit them to examine our goods, and to hand them about one to another; and they put the ſame confidence in us. If either party repented of the bargain, the goods were re-exchanged with mutual conſent and good-humour. Upon the whole, they ſeem poſſeſſed of many of the moſt excellent qualities that adorn the human mind, ſuch as induſtry, ingenuity, perſeverance, affability, and perhaps other virtues which our ſhort ſtay with them might prevent our obſerving.

"The only defect ſullying their character that we know of is their propenſity to thieving, to which we found thoſe of all ages and both ſexes addicted, and to an uncommon degree. It ſhould, however, be conſidered, that this exceptionable part of their conduct ſeemed to exiſt merely with reſpect to us; for in their general intercourſe with one another, I had reaſon to be of opinion, that thefts do not happen more frequently (perhaps leſs ſo) than in other countries, the diſhoneſt practices of whoſe worthleſs individuals are not ſuppoſed to authoriſe any indiſcriminate cenſure on the whole body of the people. Great allowances ſhould be made for the foibles of theſe poor natives of the Pacific Ocean, whoſe minds we overpowered with the glare of objects, equally new to them as they were captivating. Stealing, amongſt the civilized and enlightened nations of the world, may well be conſidered as denoting a character deeply ſtained with moral turpitude, with avarice unreſtrained by the known rules of right, and with profligacy producing extreme indigence, and neglecting the means of relieving it. But at the Friendly and other iſlands which we viſited, the thefts ſo frequently committed by the natives, of what we had brought along with us, may be fairly traced to leſs culpable motives. They ſeemed to ariſe ſolely from an intenſe curioſity or deſire to poſſeſs ſomething which they had not been accuſtomed to before, and belonging to a ſort of people ſo different from themſelves. And, perhaps, if it were poſſible that a ſet of beings ſeemingly as ſuperior in our judgment as we are in theirs ſhould appear amongſt us, it might be doubted, whether our natural regard to juſtice would be able to reſtrain many from falling into the ſame error. That I have aſſigned the true motive for their propenſity to this practice, appears from their ſtealing every thing indiſcriminately at firſt ſight, before they could have the leaſt conception of converting their prize to any one uſeful purpoſe. But I believe, with us, no perſon would forfeit his reputation, or expoſe himſelf to puniſhment, without knowing before-hand how to employ the ſtolen goods. Upon the whole, the pilfering diſpoſition of theſe iſlanders, though certainly diſagreeable and troubleſome to ſtrangers, was the means of affording us ſome information as to the quickneſs of their intellects. For their ſmall thefts were committed with much dexterity; and thoſe of greater conſequence with a plan or ſcheme ſuited to the importance of the objects. An extraordinary inſtance of the laſt ſort was, in their attempts to carry away one of the Diſcovery's anchors at mid-day.

Their common diet is made up of at leaſt nine-tenths of vegetable food; and I believe more particularly the *mahee*, or fermented bread-fruit, which makes part almoſt of every meal, has a remarkable effect upon them, preventing a coſtive habit, and producing a very ſenſible coolneſs about them, which could not be perceived in us who fed on animal food. And it is, perhaps, owing to this temperate courſe of life that they have ſo few diſeaſes among them. See n° 8.

"They only reckon five or ſix which might be called chronic, or national diſorders; amongſt which are the dropſy, and the *feſai*, or indolent ſwellings before mentioned, as frequent at Tongataboo. But this was before the arrival of the Europeans; for we have added to this ſhort catalogue a diſeaſe which abundantly ſupplies the place of all the others, and is now almoſt univerſal. For this they ſeem to have no effectual remedy. The prieſts, indeed, ſometimes give them a medley of ſimples, but they own that it never cures them. And yet they allow that in a few caſes nature, without the aſſiſtance of a phyſician, exterminates the poiſon of this fatal diſeaſe, and a perfect recovery is produced. They ſay, that if a man is infected with it he will often communicate it to others in the ſame houſe, by feeding out of the ſame utenſils, or handling them, and that, in this caſe, they frequently die, while he recovers; though we ſee no reaſon why this ſhould happen. See n° 9

Their behaviour on all occaſions ſeems to indicate a great openneſs and generoſity of diſpoſition. Omai, indeed, who, as their countryman, ſhould be ſuppoſed rather willing to conceal any of their defects, has often ſaid that they are ſometimes cruel in puniſhing their enemies. According to his repreſentation, they torment them very deliberately; at one time tearing out ſmall

Otaheitee. small pieces of flesh from different parts; at another taking out the eyes; then cutting off the nose; and lastly, killing them by opening the belly. But this only happens on particular occasions. If cheerfulness argues a conscious innocence, one would suppose that their life is seldom sullied by crimes. This, however, I rather impute to their feelings, which, though lively, seem in no case permanent; for I never saw them in any misfortune labour under the appearance of anxiety after the critical moment was past. Neither does care ever seem to wrinkle their brow. On the contrary, even the approach of death does not appear to alter their usual vivacity. I have seen them when brought to the brink of the grave by disease, and when preparing to go to battle; but in neither case ever observed their countenances overclouded with melancholy or serious reflection. Such a disposition leads them to direct all their aims only to what can give them pleasure and ease. Their amusements all tend to excite and continue their amorous passions; and their songs, of which they are immoderately fond, answer the same purpose. But as a constant succession of sensual enjoyments must cloy, we found that they frequently varied them to more refined subjects, and had much pleasure in chanting their triumphs in war, and their occupations in peace; their travels to other islands and adventures there; and the peculiar beauties, and superior advantages of their own island over the rest, or of different parts of it over other less favourite districts. This marks that they receive great delight from music; and though they rather expressed a dislike to our complicated compositions, yet were they always delighted with the more melodious sounds produced singly on our instruments, as approaching nearer to the simplicity of their own. Neither are they strangers to the soothing effects produced by particular sorts of motion, which in some cases seem to allay any perturbation of mind with as much success as music. Of this I met with a remarkable instance. For, on walking one day about Matavai Point, where our tents were erected, I saw a man paddling in a small canoe so quickly, and looking about with such eagerness on each side, as to command all my attention. At first I imagined that he had stolen something from one of the ships, and was pursued; but on waiting patiently saw him repeat his amusement. He went out from the shore till he was near the place where the swell begins to take its rise; and, watching its first motion very attentively, paddled before it with great quickness till he found that it overtook him, and had acquired sufficient force to carry his canoe before it, without passing underneath. He then sat motionless, and was carried along at the same swift rate as the wave, till it landed him upon the beach. Then he started out, emptied his canoe, and went in search of another swell. I could not help concluding, that this man felt the most supreme pleasure, while he was driven on so fast and so smoothly by the sea; especially as, though the tents and ships were so near, he did not seem in the least to envy, or even to take any notice of, the crowds of his countrymen collected to view them as objects which were rare and curious. During my stay, two or three of the natives came up, who seemed to share his felicity, and always called out when there was an appearance of a favourable swell, as he sometimes missed it, by his back being turned, and looking about for it. By them I understood that this exercise, which is called *eborooe*, was frequent amongst them; and they have probably more amusements of this sort, which afford them at least as much pleasure as skaiting, which is the only one of ours with whose effects I could compare it."

15 Language, &c. The language of these islanders is soft and melodious; it abounds with vowels, and the pronunciation of it is easily acquired: but it was found excessively difficult to teach the natives to pronounce a single English word; probably not only from its abounding with consonants, but from some peculiarity in its structure; for Spanish and Italian words, if ending in a vowel, they pronounced with the greatest ease. A sufficient acquaintance has not been formed with it to determine whether it is copious or not; but it is certainly very imperfect, being totally without inflexion either of nouns or verbs. Few of the nouns have more than one case, and few of the verbs more than one tense. It was impossible to teach the islanders to pronounce the names of their guests. They called Captain Cook *Toote*; Mr Hicks, the first lieutenant, *Hete*, &c. and in this manner they formed names for almost every man in the ship. In some, however, it was not easy to find any traces of the original; and they were perhaps not mere arbitrary sounds formed upon the occasion, but signified words in their own language; and it seems that they could perfectly remember these appellations at the distance of four years, by their inquiries after such gentlemen as were absent on the second voyage by name. Mr Monkhouse, a midshipman, they called *Matte*, which in their language signifies *dead*; because he commanded a party that killed a man for stealing a musket. The nearest imitation they could reach of king George, was by calling him *Kihiargo*. We have the following observations on this subject, in vol. ii. of Cook's last voyage to the Pacific Ocean: "The language of Otaheitee, though doubtless radically the same with that of New Zealand and the Friendly Islands, is destitute of that guttural pronunciation, and of some consonants, with which those latter dialects abound. The specimens we have already given are sufficient to mark wherein the variation chiefly consists, and to show, that, like the manners of the inhabitants, it has become soft and soothing. During the former voyage, I had collected a copious vocabulary, which enabled me the better to compare this dialect with that of the other islands; and during this voyage I took every opportunity of improving my acquaintance with it, by conversing with Omai before we arrived, and by my daily intercourse with the natives while we now remained there (A). It abounds

(A) See this vocabulary at the end of the second volume of Captain Cook's second voyage. Many corrections and additions to it were now made by this indefatigable inquirer; but the specimens of the language of Otaheitee, already in the hands of the public, seem sufficient for every useful purpose.

Otaheitee. abounds with beautiful and figurative expressions, which, were it perfectly known, would, I have doubt, put it upon a level with many of the languages that are most in esteem for their warm and bold images. For instance, the Otaheiteans express their notions of death very emphatically, by saying, "that the soul goes into darkness; or rather into night And, if you seem to entertain any doubt, in asking the question, "if such a person is their mother?" they immediately reply with surprise, "Yes, the mother that bore me." They have one expression that corresponds exactly with the phraseology of the scriptures, where we read of the yearning of the bowels."—They use it on all occasions, when the passions give them uneasiness, as they constantly refer pain from grief, anxious desire, and other affections, to the bowels, as its seat; where they likewise suppose all operations of the mind are performed Their language admits of that inverted arrangement of words which so much distinguishes the Latin and Greek from most of our modern European tongues, whose imperfections require a more orderly construction, to prevent ambiguities. It is so copious, that for the bread fruit alone, in its different states, they have above 20 names; as many for the taro root; and about 10 for the cocoanut. Add to this, that, besides the common dialect, they often expostulate in a kind of stanza or recitative, which is answered in the same manner."

A map of Otaheitee, engraved for Captain Cook's first voyage, was taken out, and laid before Tuahow the high admiral, without informing him of what it was; however, he immediately found it out, and was overjoyed to see a representation of his own country. He pointed out all the districts of it, naming every one of them in their order.

These people have a remarkable sagacity in foretelling the weather, particularly the quarter from whence the wind will blow. In their long voyages they steer by the sun in the day, and in the night by the stars; all of which they distinguish by separate names, and know in what part of the heaven they will appear in any of the months during which they are visible in their horizon. They also know the times of their annual appearing and disappearing, with more precision than would easily be believed by an European astronomer. Their time they seem to reckon by moons, 13 of which make a year. The day they divide into six parts, and the night into an equal number. They judge of the time of the day by the height of the sun, but they cannot ascertain the time of the night by the stars. In numeration, the greatest length they can go is 200; that is, when they have counted each of their fingers and toes ten times over. When they take the distance from one place to another, they express it by the time which is required to pass it.

16 Government. The government of the Otaheiteans seems greatly to resemble the early state of the European nations under the feudal system. Their orders of dignity are *earee-rahie*, which answers to king; *earee*, baron; *manahouni*, vassal; and *towtow*, villein. There are two kings in the island, one being the sovereign of each of the peninsulas of which it consists. Each of them is treated with great respect by all ranks, but does not appear to be invested with so much power as is exercised by the earees in their own districts. When the king, whom they called *O-Too*, made a visit to Otaheitee. Captain Cook, the chiefs, who happened to be there before him, immediately stripped themselves in great haste. Captain Cook took notice of it; upon which they said *earee*, *earee*, signifying, that it was on account of O-Too being present; but this was the only outward token of respect they paid him, for they never rose from their [illegible], or made any other obeisance

The *earees* are lords of one or more of the districts into which each of the peninsulas is divided, and of which there are 43 in the larger one. These parcel out their territories to the *manahounis*, who superintend the cultivation of the ground. The lowest class, called *towtows*, seem to be nearly under the same circumstances with the villeins in feudal governments. They do all the laborious work, cultivate the land, catch fish, fetch wood and water, &c. Each of the earees keeps a kind of court, and has a great number of attendants, chiefly the younger brothers of their own tribe; and among these some hold particular offices, but of which little more is known than some of their names.

In this country a child succeeds to his father's titles and authority as soon as he is born: and thus the king no sooner has a son born, than his sovereignty ceases. A regent is then chosen; and the father generally retains his power under that title, until his child becomes of age. The child of the baron succeeds to the titles and honours of its father as soon as it is born, as well as the son of the king; so that a baron who was yesterday called *earee*, and was approached with the ceremony of lowering their garments, so as to uncover the upper part of the body, is to-day, if his wife happens to be delivered of a child, reduced to the rank of a private man; all marks of respect being transferred to the child, if it is suffered to live, though the father still continues possessor and administrator of his estate. But the acquiescence which the lower class of people, or *towtows*, yield to the command of their chiefs, is very remarkable. They are not suffered to taste any animal food, although they are employed in feeding it for their lords. They endure patiently very severe blows, if, when collected into a large body, they in any manner press upon or annoy the king or a chief in his progress; and all this passive spirit is preserved without any power being lodged in the hands of the king to exact it; for he uses no military force, nor is even attended with body guards.

There are but few actions which are reckoned crimes among the Otaheiteans. Adultery, however, is sometimes punished with death: but in general, the woman escapes with a severe beating, and the gallant passes unnoticed. The regulation of public justice is not confined to the magistrate; for the injured party redresses his own wrong by inflicting whatever punishment he can upon the offender: but in matters of notorious wrong the chiefs sometimes interpose. The nobility have livery for their servants; and in proportion as the master's rank is more or less elevated, these sashes are worn higher or lower, being fastened close under the arms of the servants belonging to the chiefs, and going round the loins of those belonging to the lowest class of nobility. Several parts of the island seem to be private property, which descend to the heir of

Otaheitee

of the possessor on his death, and the descent seems to fall indifferently on man or woman. Captain Cook was of opinion that the number of inhabitants on the whole island amounted to 204,000, including women and children.

17 Religion.

The religious language of the Otaheiteans, like that of the Gentoo Bramins, is different from what is used in common discourse; but, according to the accounts we have of their notions concerning the origin of the world, nothing can be more ridiculous. They imagine that the Supreme Deity, besides a great many female descendants, has one son named *Tane;* and to him they direct their worship, though they do not believe that the good or bad conduct of mankind here on earth makes them more or less acceptable to this divinity. They believe the existence of the soul after death, and of a greater or lesser degree of happiness to be then enjoyed: but they seem to have no conception of a state of punishment or of suffering hereafter. The share of happiness which they imagine every individual will enjoy in this future state, will be assigned to him according to the rank he holds on earth. We are not, however, told wherein they suppose the happiness of this future state to consist; but it is most probably a pretty exact imitation of a Mohammedan paradise, for these voluptuaries can hardly be supposed capable of imagining any pleasure independant of the intercourse of the sexes.

The priesthood seems to be hereditary in one family or tribe; and as it is said to be numerous, probably those of that order are restrained from becoming members of the Areoy: but whether or not any peculiar decorum is necessary to be observed, hath not yet appeared. These priests are professedly the men of science; but their knowledge is altogether frivolous and useless, for it consists in being conversant with the names of their different divinities, and such absurd traditions as have been handed down among them from one generation to another. Their religious notions being deposited in an unknown tongue, they are respected because they are not understood; and as the cure of the soul is no object of regard, the most important concern to these people, the cure of their bodies, is committed to the priests, and much parade is used in their attempts to recover the sick, though their remedies consist of ridiculous ceremonies and enchantments rather than any thing else.

The marriages of these people are merely secular contracts; but no one has a right to perform the operation of tattowing except the priests; and this being a custom universally adopted by the natives, it may be supposed that performing it is a very lucrative employment. The males in general undergo a kind of circumcision, which it is disgraceful not to comply with, and which is likewise the exclusive privilege of the priests to perform. But what most establishes the credit of this order of men is their skill in astronomy and navigation.

Captain Cook, who had some reason to believe that, among the religious customs of this people, human sacrifices were sometimes offered up to their deities, went to a morai, or place of worship, accompanied by Captain Furneaux, having with them a sailor who spoke the language tolerably well, and several of the natives. In the morai was a tupapow, a kind of bier, with a shed erected over it, on which lay a corpse and some provisions. Captain Cook then asked if the plantain were for the Eatua? If they sacrificed to the Eatua hogs, dogs, fowls, &c.? To all of which an intelligent native answered in the affirmative. He then asked if they sacrificed men to the Eatua? He was answered, *taato eno,* "bad men they did; first *tiparrahy,* beating them till they were dead." He then asked if good men were put to death in this manner? His answer was no, only *taato eno.* The Captain then asked if any Earees were? The native replied, they had hogs to give the Eatua, and again repeated *taato eno.* He was then asked if towtows, who had no hogs, dogs, or fowls, but yet were good men, were ever sacrificed to the Eatua? The answer still was no, only bad men. Many other questions were put to him; all his answers to which seemed to confirm the ideas that men for certain crimes were condemned to be sacrificed to the gods, provided they did not possess any property which they might give for their redemption. However, in pursuing such inquiries as these, no certain information could be obtained, on account of the slight knowledge which had been acquired of the language of the country: but according to further accounts which Captain Cook received from Omai, it seems to rest with the high-priest to single out the victims for sacrifice; who, when the people are assembled on any solemn occasion, retires alone into the house of God, and stays there for some time; when he comes out, he informs the assembly that he has seen and conversed with the great god (the high priest alone having that privilege), and that he has asked for a human sacrifice; and tells them he has desired such a person, naming a man present, who has most probably, on some account or other, rendered himself obnoxious to this ghostly father. The words are no sooner gone out of his mouth, than the devoted wretch is put to death; for his guilt cannot be doubted, after the oracle has pronounced his doom.

On this island was seen the figure of a man constructed of basket work, rudely made, but not ill designed: it was something more than seven feet high, and rather too bulky in proportion to its height. This wicker skeleton was completely covered with feathers, which were white where the skin was to appear, and black in the parts which it is their custom to paint or stain, as well as upon the head, which was designed to represent hair. Upon the head also were four protuberances, three in front, and one behind, which the Indians called *tate ete,* little men. The image was called *Monioe;* it was a representation of *Mauwe,* one of their Eatuas, or gods of the second class, and was said to be the only one of the kind on Otaheitee.

These people pray at sun rise and sun-set. They have also a number of superstitious practices, in order to conciliate the influence of evil genii. E-Tee, a chief, who seemed to be the king's prime minister in 1774, very seriously asked Mr Forster whether they had a god *(Eatua)* in their country, and whether they prayed to him *(epore?)* When he told them that they acknowledged a divinity who had made every thing, and was invisible, and that they were accustomed to address their petitions to him, he seemed to be highly pleased, and repeated his words with comments of his own, to several persons who sat round

round him; seeming thereby to intimate, that the ideas of his countrymen corresponded with theirs in this respect.

Their morais are used both as burying-grounds and places of worship; they are approached with the most wonderful expressions of reverence and humility; and this, it should seem, not because any thing there is esteemed sacred, but because they there worship an invisible being, for whom they entertain the most reverential respect, although not excited by the hope of reward or the dread of punishment. Though they do not appear to have any visible object of worship, yet, says Captain Cook, this island, and indeed the rest that lie near it, have a particular bird, some a heron, and others a kingsfisher, to which they pay a particular regard, and concerning which they have some superstitious notions, respecting good or bad fortune, as we have of the swallow and robin redbreast, and will on no account molest or kill them. One of these cemeteries, or places of worship, was known to Captain Cook, on his first voyage, by the name of Tootahah's morai, then the regent; but when, on his second voyage, after the death of that chief, he called it by that name, Maratata, a chief that accompanied the party, interrupted him, intimating that it was no longer Tootahah's after his death, but was then known as O-Too's morai, the then reigning prince. A fine moral for princes! daily reminding them of mortality whilst they live, and teaching them, that after death they cannot call even that ground their own which their dead corpse occupies! The chief and his wife, on passing by it, took their upper garments from their shoulders. From hence it should seem, that the royal family have a particular morai, and that it always bears the name of the reigning prince.

13 rals An Indian, who had snatched away a musket from a sentry whilst on duty, was, by the inhumanity of a midshipman who commanded the guard, pursued and shot. The unhappy fate of this poor fellow gave an opportunity for seeing the manner in which these people treat their dead. They placed the corpse in the open air till the bones became quite dry: a shed was erected close by the house where the deceased had resided; it was about 15 feet long, and eleven broad; one end was left quite open; the other end, and the two sides, were partly inclosed with a sort of wicker-work. The bier was a frame of wood, like that on which the sea-beds, called *cots*, are placed, with a matted bottom, and supported by four posts, at the height of about four feet from the ground. The body was covered first with a mat, and then with white cloth; by the side of it lay a wooden mace, one of their weapons of war; and near the head of it, which lay next to the close end of the shed, lay two cocoa nut shells; at the other end a bunch of green leaves, with some dried twigs, all tied together, were stuck in the ground, by which lay a stone about as big as a cocoa-nut. Near these lay one of the young plantain-leaves that are used for emblems of peace, and close by it a stone axe. At the open end of the shed also hung, in several strings, a great number of palm-nuts; and without the shed was stuck up in the ground a stem of a plantain tree, about six feet high, upon the top of which was placed a cocoa-nut shell full of fresh water; against the side of one of the posts hung a small bag, containing a few pieces of bread-fruit ready roasted, which had not been put in all at one time, some being fresh and others stale. This minute examination of their manner of treating their dead, seemed to be very unwelcome to the natives. The food so placed by the corpse is designed as an offering to their gods. They cast in, near the body, small pieces of cloth, on which the tears and blood of the mourners have been shed; for in their paroxysms of grief it is an universal custom to wound themselves with a shark's tooth. The mourner is always a man; and he is dressed in a very singular habit. When the bones are stripped of their flesh, and become dry, they are buried. This regard to their dead is very remarkable: one of the ship's company happening to pull a flower from a tree which grew on one of their sepulchral inclosures, an Indian came suddenly behind him and struck him; and a party of sailors, who were sent to get some stones for ballast for the ship, had like to have been embroiled by the natives, by pulling down some part of an inclosure of this kind. This shade under which their dead are laid is called *tupapow*; the inclosure in which their bones are deposited is called *morai*; these latter, as has been already related, are also places of worship. As soon as a native of Otaheitee is known to be dead, the house is filled with relations, who deplore their loss; some by loud lamentations, and some by less clamorous, but more genuine expressions of grief. Those who are in the nearest degree of kindred, and are really affected by the event, are silent; the rest are one moment uttering passionate exclamations in a chorus, and the next laughing and talking without the least appearance of concern. In this manner the remainder of the day on which they assemble is spent, and all the succeeding night. On the next morning the body is shrouded in their cloth, and conveyed to the sea-side on a bier, which the bearers support upon their shoulders, attended by the priest, who having prayed over the body repeats his sentences during the procession. When it arrives at the water's edge, it is set down upon the beach; the priest renews his prayers, and taking up some of the water in his hands, sprinkles it towards the body, but not upon it. It is then carried back 40 or 50 yards; and soon after brought again to the beach, where the prayers and sprinkling are repeated. It is thus removed backwards and forwards several times; and while these ceremonies have been performing, a house has been built, and a small space of ground railed in. In the centre of this house, or *tupapow*, as they term it, posts are set up to support the bier, which is at length conveyed thither, and placed upon it; and here the body remains to putrify, till the flesh is wholly wasted from the bones. These houses of corruption are of a size proportioned to the rank of the person whose body they are to contain. Those allotted to the lower class are just sufficient to cover the bier, and have no railing round them. The largest that was seen was 11 yards long; and such are ornamented according to the abilities and inclination of the surviving kindred, who never fail to lay a profusion of good cloth about the body, and sometimes almost cover the outside of the house. Garlands of the fruit of the palm-nut, or pandanus, and cocoa-leaves, twisted by the priests in mysterious knots, with a plant called by them *ethee no morai*, which is parti-

Otaheitee. particularly consecrated to funeral solemnities, are deposited about the place; provision and water are also left at a little distance. As soon as the body is deposited in the tupapow, the mourning is renewed. The women assemble, and are led to the door by the nearest relation, who strikes a shark's tooth several times into the crown of her head; the blood copiously follows, and is carefully received upon pieces of linen, which are thrown under the bier. The rest of the women follow this example; and the ceremony is repeated at the interval of two or three days, as long as the zeal and sorrow of the parties hold out. The tears also which are shed upon these occasions are received upon pieces of cloth, and offered as oblations to the dead. Some of the younger people cut off their hair, and that is thrown under the bier with the other offerings. This custom is founded on a notion, that the soul of the deceased, which they believe to exist in a separate state, is hovering about the place where the body is deposited; that it observes the actions of the survivors, and is gratified by such testimonies of their affectionate grief. Whilst these ceremonies are carrying on by the women, the men seem to be wholly insensible of their loss; but two or three days after, they also begin to perform a part. The nearest relations take it in turn to assume the dress, and perform the offices.

The chief mourner carries in his hand a long flat stick, the edge of which is set with shark's teeth; and in a frenzy, which his grief is supposed to have inspired, he runs at all he sees, and if any of them happen to be overtaken, he strikes them most unmercifully with his indented cudgel, which cannot fail to wound them in a dangerous manner. The processions continue at certain intervals for five moons; but are less and less frequent, by a gradual diminution, as the end of that time approaches. When it is expired, what remains of the body is taken down from the bier; and the bones, having been scraped and washed very clean, are buried, according to the rank of the person, either within or without a morai. If the deceased was an earee, or chief, his skull is not buried with the rest of his bones, but is wrapped up in fine cloth, and put in a kind of box made for that purpose, which is also placed in the morai. This coffin is called *ewharre no te oremetua*, "the house of a teacher, or master." After this the mourning ceases, except some of the women continue to be really afflicted at the loss, and in that case they will suddenly wound themselves with the shark's tooth wherever they happen to be. The ceremonies, however, do not cease with the mourning; for prayers are still said by the priest, and offerings made at the morai. Some of the things, which from time to time are deposited there, are emblematical: a young plantain is said to represent the deceased, and a bunch of feathers the Deity who is invoked. The priest places himself overagainst the symbol of the god, accompanied by some of the relations, who are furnished with a small offering: he repeats his orison in a set form, consisting of separate sentences; at the same time weaving the leaves of the cocoa-nut into different forms, which he afterwards deposits upon the ground where the bones have been interred: the Deity is then addressed by a shrill screech, which is used only upon that occasion. When the priest retires, the tuft of feathers is removed, and the provisions are left to putrify, or be devoured by the rats. Otaheitee.

This ceremony of mourning, as described above, was performed by Tirope, one of the wives of Tubourai Tamaide; who, when the bleeding from the wounds which she had thus given herself ceased, looked up with a smile on the company round her, and who had before inquired of her, very earnestly, the cause of her behaviour, without receiving any answer, or having been at all noticed by her. She then began to pick up some small pieces of cloth which she had spread to catch the blood; and having got them all together, she went to the shore, and threw them into the sea. She then plunged into the river; and having washed her whole body, returned to the company as cheerful as ever. To add to the singularity of this conduct, the Indians who stood round her all the time that this frantic distress was performing, converfed with great indifference and jocularity.

There is not a more ancient custom handed down to us than that of cutting the body to express grief and distress of mind. In the code of laws delivered by Moses to the Israelites, 1400 years before the Christian era, this practice is expressly forbidden to that people: "Ye shall not cut yourselves, or make any baldness between the eyes for the dead," Deut. xiv. 1. Hence it may be supposed that this rite prevailed in Egypt, from whence the Jews derived most of those propensities which were inhibited by their great legislator. We are told likewise in the book of Kings, of the priests of Baal wounding themselves, after they had long waited in vain for the supernatural intervention of their idol. D'Arvieux informs us, that the modern Arabs retain the same custom, and that the part they chiefly wound is their arms. The difference in the practice as now prevailing in Otaheitee and Arabia seems to be, that in the first none but the women make use of it, and in the latter it is confined to the men, and generally used to express their desperate passion for some favourite mistress.

The mourning which is worn here is an head dress of feathers, the colour of which is consecrated to death, and a veil over the face. This dress is called *eeva*. The whole nation is said to appear thus on the death of their king. The mourning for fathers is very long. The women mourn for their husbands, but not the husbands for their wives.

We shall conclude this account of Otaheitee with the history of *Omai*, or, as he is improperly called *Omiah*, who was brought over to England. He was a native of Ulietea, or Raietea; and embarked at Huahine with Captain Furneaux, on board the Adventure, in September 1773; and the two ships separating in a storm on the coast of New Zealand a few months afterwards, the voyage of the Adventure was brought to a much earlier conclusion than that of the Resolution, for she arrived at Spithead the 14th of July following. This youth is said to have had some property in his native soil, of which he was dispossessed by the people of Bolabola: but he was not one of the earees, or gentry of that country, but of the middling class of people. He was eminent neither for figure, shape, nor complexion; his colour being of a deep hue, resembling a towtow, or one of the common people;

people; and both Captain Cook and Mr Forster agree in thinking him no proper sample of the inhabitants of those islands, in respect of personal beauty. However, they are both of opinion, that the qualities of his heart and head resembled those of his countrymen in general, and that no one of the natives would have given more general satisfaction by his behaviour whilst he remained in England. He is described as possessing a good understanding, quick parts, and honest principles: not an extraordinary genius like Tupia; yet not at all deficient in intelligence, which appears from his knowledge of the game of chess, in which he made an amazing proficiency. His principal patrons, whilst in England, were, the Earl of Sandwich, Mr Banks, and Doctor Solander. His noble patron introduced him to his Majesty at Kew; and, during his stay in England, he was caressed by many of the principal nobility. He naturally imitated that easy and elegant politeness which is prevalent among the great, and which is one of the ornaments of civilized society. Indeed he adopted the manners, the occupations, and amusements of his companions in general, and gave many proofs of a quick perception and a lively fancy. He appears, however, to have been treated, whilst he resided here, rather as a fashionable exhibition, than as a rational being. No attention seems to have been paid to the enriching his mind with useful knowledge, such as might have rendered him a valuable acquisition to his country on his return thither; no means were used to instruct him in agriculture, or any mechanical art or useful manufacture; and, above all, to possess him with a moral sense; to teach him the exalted ideas of virtue, and the sublime principles of revealed religion. After a stay of two years in England, and having been inoculated for the small-pox, he embarked with Captain Cook, on board the Resolution, on his return home, loaded with a profusion of presents. At parting with his friends here, his tears flowed plentifully, and his whole behaviour bespoke him to be sincerely affected at the separation: but though he lived in the midst of amusements during his residence in England, his return to his native country was always in his thoughts; and though he was not impatient to go, he expressed a satisfaction as the time of his return approached.

Such is the account of this people which our limits permit us to give. In the history of mankind it is not without importance; and in the hands of the philosopher, the moralist, or the divine, it may be useful. The subject, because but new, has been much agitated, and is pretty generally known. Such of our readers as make men and manners their peculiar study, will be anxious for further information; we must refer them, however, to those authors who have written particularly and copiously on the subject. Cook and other voyagers of eminence will at least command attention. We may just remark, that there must surely be something extremely fascinating in the persons, manners, or customs of the inhabitants, or in the soil and appearance of the country, that could tempt the greater part of a ship's crew to resist authority, and forcibly to return to Otaheitee; yet such we know was the case: and the sufferings of the commander, and those who refused to join in this vile conspiracy, and who were therefore exposed in an open boat, were indeed shocking. An account of it has been lately published.



OTALGIA, the EAR-ACH, in medicine. See there n° 80. and 364.

OTELANDS, or OATLANDS, in England, in the county of Surry, near Weybridge, was formerly a royal palace, wherein Henry duke of Gloucester, third son to King Charles I. was born; and had a deer-park, which in the late civil wars was by the parliamentarians laid open, and the house demolished. In 1673 there was a brick-wall remaining, which encompassed ten acres; but there were then small traces of the chief pile, besides the gardener's lodge, wherein was the silk-worm room raised by King James I.'s queen. It is now a most magnificent building, and commands a most extensive prospect, which words cannot describe. In the park there was a paddock, where Queen Elizabeth used to shoot with a cross bow. It is now the property of his royal highness the Duke of York, who purchased it for 43,000 l. of the Duke of Newcastle, 1789,

OTFORD, in England, in the county of Kent, by the Darent, at the bottom of a hill. In 793 there was a battle at this place, between the two Saxon kings, Offa of Mercia and Alrick of Kent, who was killed by Offa; and another in 1016, wherein the Danish king Canute was routed by King Edmund Ironside. The said Offa, to atone for the blood he had shed in that battle, first gave this place to Christ-church, Canterbury (as the deed says) *in pascua porcorum*, "for the support of the archbishop's hogs;" and so it remained in the archbishop's liberty, till exchanged with King Henry VIII. for other lands. There was a chantry founded at the Ryehouse in this parish. The church was once a chapel to Shoreham.

OTHNIEL, in sacred history, the son of Kenaz, of the tribe of Judah, We are told (Josh. xv. 17.), that Othniel was brother to Caleb; and (Judges i. 13.) it is expresly said, that he was Caleb's younger brother. There are, however, some difficulties in this; for if Caleb and Othniel had been brothers, the latter could not have married his niece Achsah the daughter of Caleb. Secondly, the scripture never assigns to Caleb and Othniel the same father: it always names Kenas as father to Othniel, and Jephunneh as the father of Caleb. Lastly, Caleb must be much older than Othniel, since he gave Othniel his daughter Achsah in marriage. Thus it seems much better to suppose Kenaz and Jephunneh to be two brothers, and that Othniel and Caleb were cousin-germans, and in this sense to be nearly related, or brothers according to the language of scripture. Thus Achsah being but second cousin in respect of Othniel, he might marry her without doing any thing contrary to the letter of the law.

Caleb having received his portion in the mountains of Judah, in the midst of a country that was possessed by giants of the race of Anak, after he had taken the city of Hebron, he advances towards Debir, otherwise called *Kirjath sepher*, and declares that he would give his daughter Achsah in marriage to him that should take Kirjath-sepher. Othniel took it, and had Achsah to wife.

After the death of Joshua, the Israelites not giving themselves the trouble to exterminate the Canaanites that

that were then in the land, and not having continued in their fidelity to the Lord, he delivered them over to Chushan-rushathaim king of Mesopotamia (Judges iii. 4, &c.), to whom they continued in subjection for eight years. Then they cried to the Lord, who raised them up a deliverer in the person of Othniel the son of Kenaz, who was filled with the spirit of God, and judged Israel. He came into the field, and gave battle to Chushan-rushathaim, beat him, and delivered Israel in the year of the world 2599; and the country was at rest for 40 years. After this Othniel died; but the precise year of his death is not known.

OTHO (M. Salvius), a Roman emperor, born A. D. 32, of a family descended from the ancient kings of Etruria. He was among the number of Nero's favourites, and accordingly was raised to the highest offices of the state, and made governor of Pannonia by the interest of Seneca, who wished to remove him from Rome, lest Nero's love for Poppæa should prove his ruin. After Nero's death Otho conciliated the favour of Galba the new emperor; but when he did not gain his point, and when Galba refused to adopt him as his successor, he resolved to make himself absolute, without any regard to the age or dignity of his friend. The great debts which he had contracted encouraged his avarice; and he procured the assassination of Galba, and made himself emperor. He was acknowledged by the Senate and the Roman people; but the sudden revolt of Vitellius in Germany rendered his situation very precarious, and it was mutually resolved that their respective right to the empire should be decided by arms. Otho obtained three victories, but in a general engagement near Brixellum his forces were defeated, and he stabbed himself when all hopes of success had vanished. This happened about the 37th year of his age, after a reign of about three months. It has been justly observed, that the last moments of Otho's life were those of a philosopher. He comforted his soldiers who lamented his fortune, and he expressed his concern for their safety when they earnestly solicited to pay him the last friendly offices before he stabbed himself; and he observed, that it was better that one man should die than that all should be involved in ruin on account of his obstinacy. His nephew was much affected and feared exceedingly the anger and haughtiness of the conqueror; but Otho comforted him, and observed, that Vitellius would be kind and affectionate to the friends and relations of Otho, since Otho was not ashamed to say, that in the time of their greatest enmity the mother of Vitellius had received every friendly treatment from his hands. He also burnt the letters which, by falling into the hands of Vitellius, might provoke his resentment against those who had favoured the cause of an unfortunate general. These noble and humane sentiments in a man who was the associate of Nero's shameful pleasures, and who had stained his hand in the blood of his master, have appeared to some wonderful, and have passed for the features of policy, and not of a naturally virtuous and benevolent heart. His father was a favourite of Claudius.

Otho, a tribune of the people, who, in Cicero's consulship, made a regulation to permit the Roman knights at public spectacles to have the 14 first rows after the seats of the senators. This was opposed with virulence by some, but Cicero ably defended it, &c.



Otho (Venius), a very celebrated Dutch painter. He was descended of a considerable family in Leyden, and was born in 1556. He was carefully educated by his parents in the belles lettres, and at the same time learned to design of Isaac Nicholas. He was but 15 when the civil wars obliged him to leave his country. He retired to Liege, finished his studies, and there gave the first proofs of the excellence of his mind. He was well known to Cardinal Groosbeek, who gave him letters of recommendation when he went to Rome, where he was entertained by Cardinal Maduccio. His genius was so active, that he applied himself to philosophy, poetry, mathematics, and painting, all at once. He became a great proficient in designing under Frederico Zuchero. He acquired an excellence in all the parts of painting, especially in the knowledge of the claro-obscuro; by which means he came to be accounted one of the most ingenious men of his age. He lived at Rome seven years, during which time he performed several rare pieces; and then passing into Germany, was received into the service of the emperor. After this the duke of Bavaria and the elector of Cologne employed him; but all the advantages he got from the courts of foreign princes could not detain him there. He had a desire to return into the Low Countries, of which Alexander Farnese, prince of Parma, was then governor. He drew the prince's picture, armed cap-a-pee, which confirmed his reputation in the Netherlands. After the death of that prince, Venius returned to Antwerp, where he adorned the principal churches with his paintings. The archduke Albert, who succeeded the prince of Parma in the government of the Low Countries, sent for him to Brussels, and made him master of the mint; a place which occupied much of his time, yet he found some time for the exercise of his profession. He drew the archduke and the infanta Isabella's portraits at large, which were sent to James I. of Great Britain: and, to show his knowledge of polite learning likewise, he published several treatises, which he embellished with cuts of his own designing. Louis III. made him very great offers to tempt him into his service; but he would never leave his own country, satisfying himself with the character and employments he held there. He was the first, after Polydore Caravaggio, who reduced the claro-obscuro to a principle of the art of painting. Rubens perfected what he began, and the whole Flemish school learned *it* off him. Venius died at Brussels, 1634, in his 78th year. He had two brothers, Gilbert, who was a graver, and Peter a painter. He had also the honour of breeding up the famous Rubens in his art.

OTHONNA, in botany: A genus of the polygamia necessaria order, belonging to the *syngenesia* class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The receptacle is naked; there is almost no papus; the calyx is monophyllous, multifid, and nearly cylindrical.

OTHRYADES, one of the 300 Spartans who fought against 300 Argives, when those two nations disputed their respective right to Thyreata. Two Argives, Alcinor and Cronius, and Othryades, survived the

Otis, Otley

the battle. The Argives went home to carry the news of their victory; but Othryades, who had been reckoned among the number of the slain on account of his wounds, recovered himself, and carried some of the spoils of which he had stripped the Argives into the camp of his countrymen; and after he had raised a trophy, and had written with his own blood the word *vici* on his shield, he killed himself, unable or unwilling to survive the death of his countrymen.

OTIS, in ornithology, a genus of birds belonging to the order of grallæ. There are four species, principally distinguished by their colour. One of the species, the tarda, or bustard, is the largest of the British land-fowl; the male at a medium weighing 25 pounds; there are instances of some very old ones weighing 27: The breadth nine feet; the length near four. Besides the size and difference of colour, the male is distinguished from the female by a tuft of feathers about five inches long on each side of the lower mandible. Its head and neck are ash-coloured: the back is barred transversely with black and bright rust colour: the greater quill-feathers are black: the belly white: the tail is marked with broad red and black bars, and consists of twenty feathers: the legs dusky.

The female is about half the size of the male: the crown of the head is of a deep orange, traversed with black lines; the rest of the head is brown. The lower part of the fore-side of the neck is ash coloured: in other respects it resembles the male, only the colours of the back and wings are far more dull.

These birds inhabit most of the open countries of the south and east parts of this island, from Dorsetshire, as far as the Wolds in Yorkshire. They are exceeding shy, and difficult to be shot; run very fast, and when on the wing can fly, though slowly, many miles without resting. It is said that they take flight with difficulty, and are sometimes run down with greyhounds. They keep near their old haunts, seldom wandering above 20 or 30 miles. Their food is corn and other vegetables, and those large earth-worms that appear in great quantities on the downs before sunrising in the summer. These are replete with moisture, answer the purpose of liquids, and enable them to live long without drinking on those extensive and dry tracts. Besides this, nature hath given the males an admirable magazine for their security against drought, being a pouch, whose entrance lies immediately under the tongue, and which is capable of holding near seven quarts; and this they probably fill with water to supply the hen when sitting, or the young before they can fly. Bustards lay only two eggs, of the size of those of a goose, of a pale olive-brown, marked with spots of a dark colour; the make no nest, only scrape a hole in the ground. In autumn they are (in Wiltshire) generally found in large turnip-fields near the Downs, and in flocks of 50 or more.

Plate CCCLXIX.

OTLEY, a town of England, in the West Riding of Yorkshire, under a cliff called *Chevin*, on the south side of the river Wherfe. The adjacent parts are reckoned the most delightful in England. Its church has lately been elegantly fitted up, in which are several good old monuments. The adjacent country is much improved, and from the Chevin is a most beautiful view of an extensive scope of undescribed mansions. This manor was given by Athelstan to the see of York, whose archbishop had a palace here, with several extensive privileges. There is a free grammar-school in this place, founded by Mr Cave, 1611, called *Prince Henry's School*. In 1673, it suffered much by an inundation; which carried away several bridges, mills, &c. as well as much corn, &c.

Otodini, Otranto.

OTODINI, ancient Britons, seated, as some suppose, to the north east of the Brigantes, in the countries now called Northumberland, Merse, and the Lothians. As the Otodini are not mentioned by any of the Roman historians, but only by Ptolemy, it is uncertain whether they formed a distinct independent state, or were united with the Brigantes. They were, however a considerable people, and possessed a long tract of the sea-coast, from the river Tine to the Frith of Forth. Their name is derived by Baxter from the old British words *Ot o dineu*, which signify "a high and rocky shore;" descriptive enough of their country. They were probably reduced by Agricola at the same time with their more powerful neighbours the Brigantes; but as they lived without the wall of Severus, they were, like the rest of the Mæatæ, engaged in frequent revolts. In the most perfect state of the Roman government in this island, the country of the Otodini made a part of the Roman province called Valentia; which comprehended all that large tract between the two walls. As this province was never long together in the peaceable possession of the Romans, they had but few stations in the country of the Otodini, except those on the line of the wall of Severus.

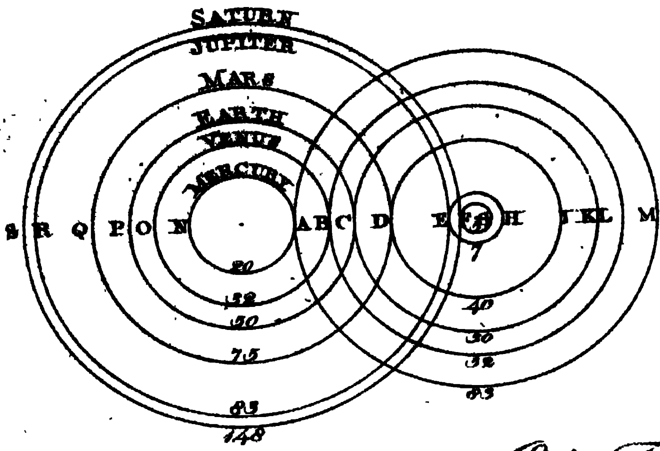
*Henry's Hist. Gr. Brit.* vol. I p. 185, &c.

Various authors have derived the name of this people in various ways, and it is very differently spelled; and various opinions still seem to be en among the learned respecting their real situation; it is even doubtful whether their country was in England or in Scotland. The celebrated Drummond of Hathornden contends for the latter.

OTRANTO, or TERRA D'OTRANTO, a province of Italy in the kingdom of Naples; bounded on the north by the Terra di Bari and by the gulph of Venice, on the east by the same gulph, and on the south and west by a great bay which is between that and the Basilicata. It is a mountainous country, abounding in figs, olives, and wine. It is often visited by locusts, and by Algerine pirates, who carry off all the people they can catch into slavery. But to keep them off, there are a great many forts on the coasts.

OTRANTO, a city of Italy, in the kingdom of Naples, and capital of the province of the same name, with a commodious harbour, an archbishop's see, and a strong citadel, where the archbishop resides. Mr Swinburne * gives this account of it: "It is (says he) small, stands on a hill, and contains only 3000 inhabitants. Its little harbour is not so bad but it might induce more people to settle here, as no port on the coast lies so convenient for traffic with Greece. The Adriatic gulph is here but 60 miles wide. I climbed to the top of a tower, to get a sight of the Acroceraunian mountains; but a vapour hanging over the sea, along the horizon, hid them from my view: in a clear morning, their snowy tops are said to be very visible. The cathedral of Otranto is Gothic, and, according to the Puglian fashion, has its subterraneous sanctuary. The columns are of beautiful marble and granite; the

* *Travels in the two Sicilies*, vol. I.




Otis Tarda.

Ostrea Ephippium

Ostrea Edulis

the pavement a rude species of mosaic, commonly called *Saracenic*: As it is to be met with in all churches founded by the Norman kings of Sicily, the artists who laid it were probably Saracens, or at least Greeks, their scholars. These mosaics are composed of pieces of porphyry, serpentine, and cubes of gilt glass,—disposed in stars, circles, or chequers. The compartments of the stalls are bordered with them; and the small twisted columns, which support the pulpits and canopies, are ornamented with a spiral stripe of the same work. It is a pity so much durability, compactness, and beauty of materials, should have been lavished on such barbarous designs. Otranto was a Roman colony, as is certified by an inscription, almost the only monument of antiquity left there (A). In the 10th century it was made an archbishop's see. In 1480, Laurence de Medici, to deliver himself from the attacks of the king of Naples, persuaded Mahomet II. to invade the realm; and Otranto was the unfortunate place where the Turks landed. It was invested, stormed, and pillaged. Its prelate was slain at the door of his church; 800 principal citizens dragged out of the gates and butchered; their bodies left 12 months unburied, till the duke of Calabria retook the city, and committed them to hallowed earth. About 100 years after, a devout person affirmed, that these bones had appeared to him in a dream; and, upon the strength of his vision, they became, for the vulgar, objects of almost equal veneration with the relicks of the primitive martyrs."

OTRICOLI, a small town of Italy, in the ecclesiastic state, and in the duchy of Spoleto, in E. Long. 13. 15. N. Lat. 42. 25. situated on a rising ground on the frontiers of the patrimony of St Peter. From this town is seen a fine plain, and some of the windings of the famous river Tiber. The ruins that are scattered here and there at the entrance of the plain, descending from Otricoli, are thought to be the remains of the ancient Otricolum; they consist of some shapeless fragments of columns, cornices, and other pieces of marble. In the middle of the great street of Otricoli, there is a marble pedestal, upon which you see an inscription, showing they had erected a statue to Julia Lucilla, who had built public baths at Otricoli at her own expence.

OTTER, in zoology. See MUSTELA.

*OTTER of Roses.* See ROSES.

OTTERBURN, in England, in the county of Northumberland, near Ellesdon. It was the field of battle between the English and Scots in 1388, wherein Henry Percy, called *Hotspur*, was taken prisoner, and Douglas the Scotch general was killed. On this battle was founded the delightful old ballad of Chevy-chaise; the village being situated by the river Rhead, on the south side of the Cheviot hills. The entrenchments are still visible; and a number of tumuli scattered over the adjacent ground mark to future ages the slaughter made there.

OTTERY, ST MARY'S, a market town in Devonshire, situated 159 miles west of London, and 10 miles east of Exeter. Its market is on Tuesdays, and it has two fairs. The church is very ancient, and somewhat resembles a cathedral. A very extensive woollen manufactory was lately established here by Sir Geo. Yonge and Sir John Duntze, barts. It has no corporation. It derived its name, as some suppose, from the river Otter, and that from the otters formerly found in it. This town was given by king Edward the Confessor to the church of St Mary at Roen in Normandy; but was afterwards bought by Grandison bishop of Exeter; who made of it a quarter college in 10 Edward III. and therein placed secular priests, with other ministers, to whom he gave the whole manor, parish, tythes, fines, spiritual profits, &c. which amounted to L. 304 : 2 : 10 yearly.



OTWAY (Thomas), an eminent tragic poet, was the son of Mr Humphry Otway, rector of Wolbeding in Sussex; and was born at Trottin in that county on the 3d of March 1651. He was educated at Oxford; when, leaving the university without a degree, he retired to London, where he commenced player, but with indifferent success. However, the sprightliness of his conversation gained him the favour of Charles Fitz-Charles earl of Plymouth, who procured him a coronet's commission in one of the new-raised regiments sent into Flanders; but he returned from thence in very necessitous circumstances, and applied himself again to writing for the stage. In comedy he has been deemed too licentious; which, however, was no great objection to his pieces in the profligate days of Charles II. But, in tragedy, few English poets have ever equalled him; and perhaps none ever excelled him in touching the passions, particularly the tender passion. There is generally something familiar and domestic in the fable of his tragedies, and there is amazing energy in his expression.—The heart that doth not melt at the distresses of his Orphan must be hard indeed! But though Otway possessed in so eminent a degree the rare talent of writing to the heart, yet he was not very favourably regarded by some of his cotemporary poets, nor was he always successful in his dramatic compositions. After experiencing many reverses of fortune in regard to his circumstances, but generally changing for the worse, he at last died wretchedly in a public house on Tower hill; whither it is supposed, he had retired, in order to avoid the pressure of his creditors. Some have said, that downright hunger compelling him to fall too eagerly on a piece of bread, of which he had been for some time in want, the first mouthful choaked him, and instantly put a period to his days. Dr Johnson gives this account of the matter: "He died in a manner which I am unwilling to mention. Having been compelled by his necessities to contract debts, and hunted, as is supposed, by the terriers of the law, he retired to a public-house on Tower hill, where he died of want; or, as it is related by one of his biographers, by swallowing, after a long fast, a piece of bread which charity had supplied He went out, as is reported, almost naked, in the rage of hunger, and finding a gentleman in a neighbouring coffee-house, asked him for a shilling. The gentleman gave him a guinea; and Otway

(A) "Num. Hydr.—ÆR Caput barb. & laureat. ΤΑΡΟΝΤΙΝΩΝ. = Tridens, cum duobus delphinibus."

way going away bought a roll, and was choaked with the first mouthful. All this, I hope, is not true; but that indigence, and its concomitants, sorrow and despondency, brought him to the grave, has never been

Johnson speaks of him in nearly these terms: Otway had not much cultivated versification, nor much replenished his mind with general knowledge. His principal power was in moving the passions, to which Dryden in his latter years left an illustrious testimony. He appears, by some of his verses, to have been a zealous royalist; and had what was in those times the common reward of loyalty; he lived and died neglected—His dramatic writings are nine in number; the most admired of which are, *The Orphan*, and *Venice Preserved*. He had also made some translations, and wrote several miscellaneous poems. His whole works are printed in two pocket volumes. He wrote four acts of a play which are lost.

OVAL, an oblong curvilinear figure, otherwise called *ellipsis*. (See ELLIPSIS). However, the proper oval, or egg shape, differs considerably from that of the ellipsis, being an irregular figure, narrower at one end than at another: whereas the ellipsis or mathematical oval, is equally broad at each end: though it must be owned, these two are commonly confounded together; even geometricians calling the oval a *false ellipsis*.

OVARY, in anatomy, that part of a female animal wherein the ova or eggs are formed or lodged. See ANATOMY, n° 108. p. 740.

OVARIUM, in botany, a name by which botanists who are fond of assimilating the animal and vegetable kingdoms have distinguished the germen or seed bud, as containing the rudiments of the future seed.

OVATION, in the Roman antiquity, a lesser triumph, granted to commanders for victories won without the effusion of blood; or for defeating a mean and inconsiderable enemy. The show generally began at the Albanian mountain, whence the general with his retinue made his entry into the city on foot, with many flutes or pipes sounding in concert as he passed along, and wearing a garland of myrtle as a token of peace. The term *ovation*, according to Servius, is derived from *ovis*, a "sheep;" because on this occasion the conqueror sacrificed a sheep, as in triumph he sacrificed a bull. The senate, knights, and principal plebeians, assisted at the procession; which concluded at the Capitol, where rams were sacrificed to Jupiter. The first ovation was granted to Publius Posthumius the consul, for his victory over the Sabines in the 253d year of Rome.

OUDENARDE, a rich and strong town of the Austrian Netherlands, in the province of Flanders, in E. Long. 3. 30. N. Lat. 50. 54. fifteen miles south of Ghent, and eighteen from Tournay. It is a large well fortified town, having a very considerable fort in the middle of it, situated on the river Scheldt, which divides it into two parts. It is almost encompassed by meadows, only there is a hill which commands it on the south side. The buildings are pretty good, and the streets wide and handsome. The market-place is adorned with a beautiful town-house, and a fine large fountain. There are several good churches and monasteries well worthy of the notice of travellers. The town has a very flourishing trade in fine linen and tapestry, and is the capital of a castellany, which contains 33 villages. The French laid siege to it in 1708, which brought on an obstinate engagement, wherein they were defeated by the allies under the command of the duke of Marlborough. It was besieged by the French again in 1745, and taken in a few days; but they restored it at the last general peace.

OUDRI (Jean Baptiste), a painter, was born at Paris, and died there May 1. 1755, aged about 74. He acquired the principles of his art under the celebrated Largillieres; and from this master he had those sure principles of colouring which he communicated at a meeting of the academy of painting, of which he was a member, and one of the professors. Oudri's superior talent for painting animals is well known: his compositions of this kind are full of truth, and are admirably handled. The Fables of la Fontaine have been engraved in 4 vols folio from his etchings; but those who finished them possessed not equal abilities. He painted several hunting-pieces for the king, which adorn some of the royal castles, among others that of La Meute. Oudri was so well acquainted with the magic of his art, that he frequently pleased himself with painting white objects on white grounds; and these pictures have a good effect. He would likewise have succeeded in history-painting, as we may easily infer from several pieces which do him honour. He superintended the manufactory of Beauvais, where pieces of tapestry were produced equally brilliant with the pictures which had served for their model. The king gave him a pension, and apartments in the Louvre.

OVERALL (John), a celebrated English bishop, was born in 1559; and, after a proper foundation in grammar learning, was sent to St John's college, Cambridge, and was elected a scholar of that society: but afterwards removing to Trinity, was chosen fellow of that college. In 1596 he was made regius professor of divinity, when he took the degree of D. D. and about the same time was elected master of Catherine-hall. In 1601 he was raised to the deanery of St Paul's, London, by the recommendation of his patron Sir Fulk Greville, and Queen Elisabeth; and in the beginning of King James's reign, he was chosen prolocutor of the lower house of convocation. In 1612 he was appointed one of the first governors of the Charter-house hospital, then just founded by Thomas Sutton, Esq. In April 1614 he was made bishop of Litchfield and Coventry; and in 1618 he was translated to Norwich, where he died in May 1619, aged, as it is reported, 60 years He was buried in that cathedral, where he lay unnoticed and forgotten till some time after the restoration of Charles II. when Cosin, bishop of Durham, who had been his secretary, erected a monument in 1669, with a Latin inscription, in which he is said to be, "Vir undequaque doctissimus, et omni encomio major."

Wood observes, that he had the character of being the best scholastic divine in England; and Cosin, who perhaps may be thought to rival him in that sort of learning, calls himself his scholar, and absolutely says that he derived all his knowledge from him. He is also celebrated by Smith for his distinguished wisdom, erudition, and piety. In the controversy which in

Overall, Overbury.

in his time divided the reformed churches about predestination and grace, he held a middle opinion, inclining perhaps to Arminianism. He seems indeed to have paved the way for the reception of that doctrine in England, where it was generally embraced a few years afterwards, chiefly by the authority and influence of Archbishop Laud. Overall cultivated a particular friendship with Gerard Vossius and Grotius; and was much grieved to see the love of peace, and the projects of this last great man to obtain it, so ill repaid. He laboured heartily himself to settle the differences in Holland, upon what is known by the name of the *Quinquarticular controversy;* as appears in part by his letters to the two learned correspondents just mentioned, some of which are printed in the *Epistolæ præstantium virorum*, &c.

The bishop is known in England chiefly by his *Convocation Book*, of which Bishop Burnet gives the following account: "This book was wrote on the subject of government, the divine institution of which was very positively asserted. It was read in convocation, and passed by that body, in order to the publishing of it; in opposition to the principles laid down in the famous book of Parsons the Jesuit, published under the name of *Doleman*. But King James did not like a convocation entering into such a theory of politics; so he discouraged the printing of it, especially since, in order to justify the owning of the United Provinces, who had lately thrown off the Spanish yoke, to be a lawful government, it was laid down, that when a change of government was brought to a thorough settlement, it was then to be owned and submitted to as a work of the providence of God. Here it slept, till Archbishop Sancroft, who had got the book into his own hands, and not observing the last-mentioned passage in it, resolved to publish it in the beginning of King William's reign, as an authentic declaration the church of England had made in the point of non-resistance. Accordingly it was published in 4to, as well as licensed, by him, a very few days before he was under suspension for not taking the oaths."

OVERBURY (Sir Thomas), a learned and worthy English gentleman, was born in 1581; and studied at Queen's college, Oxford, after which he removed to the Middle-Temple, London. He afterwards travelled for some time, and returned a most accomplished person; when he contracted an intimate acquaintance with Sir Robert Carr, knight of the Bath, who being soon after taken into his majesty's favour, had Mr Overbury knighted at Greenwich. Sir Thomas perceiving the familiarity which subsisted between his patron Carr, now made viscount Rochester, and the lady Frances, the wife of Robert earl of Essex, was so much displeased at it, that he endeavoured to dissuade him from keeping her company, and from proceeding in the base design he had formed of having her first divorced from her husband, and then marrying her. The viscount, resenting this honest advice, told what he had said to the lady, who was as remarkable for her wickedness as for her beauty; on which they immediately resolved on his destruction. About this time, the king wanting to send an ambassador abroad, the viscount recommended Sir Thomas Overbury. His majesty approving the choice, the viscount imparted the king's intentions to Sir Thomas; but, under a treacherous show of friendship, dissuaded him from accepting of that employment, as it might hinder him from a better way of advancement; promising that he would prevent his majesty from being displeased at his refusal. The viscount then went to the king, and artfully incensing his majesty against Sir Thomas for refusing to obey his commands, that gentleman was committed to the Tower for his contempt, on the 21st of April 1613, where he continued till he was dispatched by poison on the 15th of September following, and his body was interred in the Tower-chapel the same day. About two years after, the whole contrivance of his death was discovered. On this several persons were condemned and executed; but though Carr, earl of Somerset, and the lady Frances his countess, were condemned to death for contriving the murder, and hiring the persons who were concerned in it, the king only banished them from court, and afterwards pardoned them. Sir Thomas Overbury wrote several poems, &c. and an account of his travels.

Overbury, Over-hauling.

His character is represented by an historian of those times; who, after relating the occasion and circumstances of his death, proceeds in the following terms: "In this manner fell Sir Thomas Overbury, worthy of a longer life and a better fate; and, if I may compare private men with princes, like Germanicus Cæsar, both by poison procured by the malice of a woman, both about the 33d year of their age, and both celebrated for their skill and judgment in poetry, their learning, and their wisdom. Overbury was a gentleman of an ancient family, but had some blemishes charged upon his character, either through a too great ambition, or the insolence of a haughty temper.—— After the return from his travels, the viscount Rochester embraced him with so entire a friendship, that, exercising by his majesty's special favour the office of secretary provisionally, he not only communicated to Sir Thomas the secrets, but many times gave him the packets and letters unopened, before they had been perused by the king himself: which as it prevailed too much upon his early years, so as to make him, in the opinion of some, thought high and ambitious; yet he was so far from violating his trust and confidence, that he remains now one example among others who have suffered in their persons or their fortunes for a freedom of advice, which none but sincere friends will give, and which many are such ill friends to themselves as not to receive."

OVEN, a kind of domestic furnace, used for baking bread, pies, tarts, &c. of a circular structure, with a very low roof, well lined, both on the top, bottom, and sides, with stone; it has a small entrance in the front, which is exactly fitted by a kind of door, which being clapped to the mouth of the oven confines the heat, while bread, pies, or puddings, are baking. Over this, pastry cooks, &c. have another oven built much in the same manner, which is used for such things as require a less degree of heat. Ovens are heated by burning dry wood, faggots, &c. in them, till all the parts are equally hot.

OVER-HAULING, the act of opening and extending the several parts of a tackle, or other assemblage of ropes, communicating with blocks or dead eyes. It is used

Over-hauling || Oughtred. used to remove those blocks to a sufficient distance from each other, that they may be again placed in a state of action, so as to produce the effect required.

*Over-Hauling*, is also vulgarly expressed of an examination or inspection into the condition of a person or thing.

*Over-Rake*, among seamen: When a ship riding at anchor so overbeats herself into an high sea, that she is washed by the waves breaking in upon her, they say the waves over-rake her.

*Over-Reach*, in Farriery. See there, § xl. 2.

OVERSMAN, in Scots law, a person appointed by arbiters, or by the parties submitters, to determine the matter submitted, in case the parties disagree in their opinion.

OVERT, the same with Open: Thus an overt act signifies an act which, in law, must be clearly proved; and such is to be alleged in every indictment for high treason.

OVERTURE, or Ouverture, opening or preluding: a term used for the solemnities at the beginning of a public act or ceremony; an opera, tragedy, comedy, concert of music, &c. The overture of the theatre or scene, is a piece of music usually ending with a fugue: the overture of a jubilee is a general procession, &c.

OVERYSSEL, so named from its situation beyond the river Yssel, one of the Seven united Provinces; bounded on the east by the bishopric of Munster, on the north by Friesland and the territory of Groningen, on the west by the river Yssel, and on the south by the county of Zutphen and the bishopric of Munster. It is divided into three distinct parts; which are the territories of Drense, Twente, and Salland. There are many morasses in this province, and but few inhabitants, in comparison of the rest. Its greatest riches consist in turfs; which are dug up here, and sent to the neighbouring provinces, particularly Holland. It extends near 60 miles in length from north to south, and 40 in breadth from east to west. The whole country is low and marshy, but it produces a tolerable quantity of corn. It was formerly a dependance of the bishopric of Utrecht, before Henry of Bavaria, bishop of that see, transferred the sovereignty of it to the emperor Charles V.

OVIEDA, in botany: A genus of the angiospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 40th order, *Personatæ*. The calyx is quinquefid; the tube of the corolla almost cylindrical above, and very long; the berry globose and dispermous.

OVIEDO, a town of Spain, and capital of Asturias d'Oviedo, with a bishop's see, and an university; seated at the confluence of the rivers Ove and Deva, which form the Asta, 50 miles north-west of Leon, and 208 north-west of Madrid. W Long. 5. 47. N. Lat. 43. 23.

OUGHTRED (William), an eminent mathematician, was born at Eton in 1573, and educated in the school there, whence he was elected to King's-college in Cambridge, of which he afterwards became fellow. Being admitted to holy orders, he left the university about the year 1603, and was presented to the rectory of Aldbury, near Guildford in Surry; and about the year 1628 was appointed by the Earl of Arundel to instruct his son in the mathematics. He kept a correspondence by letters with some of the most eminent scholars of his time upon mathematical subjects; and the most celebrated mathematicians of that age owed most of their skill to him, whose house was full of young gentlemen that came from all parts to receive his instruction. It is said that, upon hearing the news of the vote at Westminster for the restoration of King Charles II. he expired in a sudden transport of joy, aged 88. He wrote, 1. *Clavis Mathematica*; which was afterwards published in England. 2. A description of the double horizontal dial. 3. *Opuscula Mathematica*; and several other works. He left also behind him a great number of papers upon mathematical subjects, which are now in the museum of William Jones, Esq; F. R. S. Oughtred, Ovid.

David Lloyd, in his Memoirs, has given the following short character of him: "That he was as facetious in Greek and Latin, as solid in arithmetic, geometry, and the sphere of all measures, music, &c. exact in his style as in his judgment; handling his tube and other instruments at 80 as steadily as others did at 30; owing this, as he said, to temperance and archery; principling his people with plain and solid truths, as he did the world with great and useful arts; advancing new inventions in all things but religion, which, in its old order and decency, he maintained secure in his privacy, prudence, meekness, simplicity, resolution, patience, and contentment." He had one son, whom he put an apprentice to a watchmaker, and wrote a book of instructions in that art for his use.

OVID, or *Publius Ovidius Naso*, a celebrated Latin poet of the Augustan age, was a Roman knight, born at Sulmo, in the 43d year before the Christian era. He studied rhetoric under Aurelius Fuscus, and for some time frequented the bar. His progress in the study of eloquence was great, but the father's expectations were frustrated; his son was born a poet, and nothing could deter him from pursuing his natural inclination to write poetry, though he was often reminded that Homer lived and died in the greatest poverty. Every thing he wrote was expressed in poetical numbers, as he himself says, *Et quod tentabam scribere versus erat*. A lively genius and a fertile imagination soon gained him admirers: the learned became his friends; Virgil, Propertius, Tibullus, and Horace, honoured him with their correspondence, and Augustus patronized him with the most unbounded liberality. These favours, however, were but momentary; for after having obtained the esteem of Augustus, he incurred his displeasure, and was banished to Tomos, a city on the Pontus Euxinus, near the mouth of the Danube, when he was 50 years of age. The true cause of this sudden exile is unknown. Some attribute it to a shameful amour with Livia the wife of Augustus, while others suppose that it arose from the knowledge which Ovid had of the unpardonable incest of the emperor with his daughter Julia. These reasons are indeed merely conjectural; the cause was of a very private and very secret nature, of which Ovid himself is afraid to speak. It was, however, something improper in the family and court of Augustus, as these lines seem to indicate:

*Cur aliquid vidi? Cur noxia lumina feci?*
*Cur imprudenti cognita culpa mihi est?*

*Inscius*

*Inscius Actæon vidit fini veste Dianam,*
*Præda fuit canibus non minus ille suis.*

Again,

*Inscia quod crimen viderunt lumina plector,*
*Peccatumque oculos est habuisse meum.*

And in another place,

*Perdiderunt cum me duo crimina, carmen & error,*
*Alterius facti culpa silenda mihi est.*

In his banishment, Ovid betrayed his pusillanimity in a great degree; and however affected and distressed his situation was, yet the flattery and impatience which he showed in his writings are a disgrace to his pen, and lay him more open to ridicule than to pity. Though he prostituted his pen and his time to adulation, yet the emperor proved deaf to all intreaties, and refused to listen to his most ardent friends at Rome who wished for his return. Ovid, who really wished for a Brutus to deliver Rome of her tyrannical Augustus, still continued his flattery even to meanness; and when the emperor died, he was so mercenary as to consecrate a small temple to the departed tyrant on the shore of Euxine, where he regularly offered frankincense every morning. Tiberius proved as regardless as his predecessor to the intreaties which were made for the poet, and he died in the seventh or eighth year of his banishment, in the 57th year of his age. He was buried at Tomos. In the year 1508 of the Christian era, the following epitaph was discovered at Stain, in the modern kingdom of Austria.

*Hic situs est vates quem Divi Cæsaris ira.*
*Augusti patria cedere jussit humo.*
*Sæpe miser voluit patriis occumbere terris,*
*Sed frustra! hunc illi fata dedere locum.*

This, however, is an imposition to render celebrated an obscure corner of the world, which never contained the bones of Ovid. The greatest part of his poems are remaining. His *Metamorphoses*, in 15 books, are extremely curious, on account of the great variety of mythological facts and traditions which they relate, but they can have no claim to epic honours. In composing this the poet was more indebted to the then existing traditions, and to the theogony of the ancients, than the powers of his own imagination. His *Fasti* were divided into 12 books, like the constellations in the zodiac, but of these six are lost; and the learned world have reason to lament the loss of a poem which must have thrown so much light upon the religious rites and ceremonies, festivals and sacrifices, of the ancient Romans, as we may judge from the six that have survived the ravages of time and barbarity. His *Tristia*, which are divided into five books, contain much elegance and softness of expression; as also his *Elegies* on different subjects. The *Heroides* are nervous, spirited, and diffuse; the poetry is excellent, the language varied, but the expressions are often too wanton and indelicate; a fault which is very common with him. His three books *Amorum*, and the same number *de Arte Amandi*, with the other *de Remedio Amoris*, are written with peculiar elegance, and contain many flowery descriptions; but the doctrine which they hold forth is dangerous, and they are to be read with caution, as they seem to be calculated to corrupt the heart, and to sap the very foundations of virtue and morality. His *Ibis*, which is written in imitation of a poem of Callimachus of the same name, is a satyrical performance. Besides these, there are extant some fragments of other poems, and among these part of a tragedy called *Medea*. The talents of Ovid as a dramatic writer has been disputed, and some have remarked that he who is so often void of sentiment was not born to shine as a tragedian. He has attempted, perhaps, too many sorts of poetry at once. On whatever he has written, he has totally exhausted the subject. He everywhere paints nature with a masterly hand, and adds strength even to vulgar expressions. It has been judiciously observed, that his poetry after his banishment from Rome was destitute of that spirit and vivacity which we admire in those which were written before. His *Fasti* are perhaps the best written of all his poems; and after them we may fairly rank his love verses, his *Heroides*, and after all his *Metamorphoses*, which were not totally finished when Augustus banished him. His *Epistles from Pontas* are the language of a weak and sordid flatterer. However critics may have cause to censure the indelicacy and the inaccuracies of Ovid, it is to be acknowledged that his poetry contains great sweetness and elegance, and, like that of Tibullus, charms the ear and captivates the mind.—Another person of the name of Ovid accompanied his friend Cæsonius when banished from Rome by Nero.



OVIEDO (John Gonsalvez de), born at Madrid about the year 1478, was educated among the pages of Ferdinand king of Arrogan and Isabella queen of Castile; and happened to be at Barcelona in 1493, when Christopher Columbus returned from his first voyage to the island Haiti, which he called Hispaniola, and which now goes by the name of St Domingo. He formed an intimate acquaintance with Columbus and his companions, and was at pains to inform himself of every thing relating to the new discoveries. He rendered such essential service to Spain during the war of Naples, that Ferdinand determined to send him to the island of Haiti, as intendant and inspector general of the trade of the New World. The ravages which the venereal disease had made during that war, induced him to inquire into what were the most efficacious remedies for this malady, which was supposed to have come from the West Indies. His inquiries were extended to every thing which regards the natural history of these regions; and, on his return to Spain, he published *Summario de la Historia general y natural de las Indias Occidentales*, which he dedicated to Charles V. He afterwards made some additions to this work, which he published under the title of *La Historia general y natural de las Indias Occidentales*; Salamanca, 1535, folio. It was translated into Italian, and afterwards into French; Paris, 1556, folio. In this work, Oviedo says that the French pox is endemical in the island of Haiti, and that it has passed from thence into Europe. He greatly extols the use of the wood of guiacum for the cure of this disease; but whether the disease is now become more obstinate, or the remedy does not possess that efficacy which is ascribed to it, it is at present in little estimation.

OVILIA, or Septa, in ancient Rome, a place in the Campus Martius, at first railed in like a sheep-pen, whence its name. Afterwards it was mounted with marble,

Oviparous, Ovis.

marble, and beautified with walks and galleries, as also with a tribunal, or seat of justice. Within this precinct or inclosure the people were called to give their suffrages for the election of magistrates. The ascent into the ovilia was not by stairs, but by pontes, or narrow boards, laid there for the occasion; on which account *de ponte dejici*, signified "to be deprived of the privilege of voting;" and persons thus dealt with were called *depontani*.

OVIPAROUS, a term applied to such animals as bring forth their young from eggs; as birds, insects, &c.

OVIS, the SHEEP, in Zoology, a genus of the mammalia class, and of the order of Pecora; the characters of which are these: The horns are concave, turned backwards, and full of wrinkles; there are eight fore-teeth in the under-jaw, and no dog-teeth The wool of these animals is only a congeries of very long and slender hairs, oddly twisted and contorted, and variously interwoven with one another. This, as far as is yet known, is a clothing peculiar to the sheep kind, no other animal having been seen to possess it. It is not, however, the clothing of all the species of sheep, some that are found in distant nations having short hair like that of the goat.

Plate CCCLXX.

Linnæus enumerates three species, which are perhaps only varieties, viz. 1. The *ovis aries*, or ram sheep, the horns of which are shaped like a half moon, and compressed. 2. The *ovis Guineensis*, or Guinea sheep, which has pendulous ears, lax hairy dewlaps, and a prominence on the hind part of the head. The wool is short like that of a goat. It is, as its name imports, a native of Guinea. And, 3. The *ovis strepsiceros*, or Cretan sheep, which has strait cariated horns, twisted in a spiral manner, and is a native of Mount Iola. According to Mr Pennant, the last two are to be reckoned only varieties.

The sheep, unquestionably a mild and gentle creature, is also represented by Buffon as the most stupid, defenceless, and timid of all quadrupeds; insomuch that, without the assistance of man, it could never, he thinks, have subsisted or continued its species in a wild state.

*Buff. Nat. Hist.* vol. iii. p. 403

"The female is absolutely devoid of every art and of every mean of defence. The arms of the ram are feeble and awkward. His courage is only a kind of petulence, which is useless to himself, incommodious to his neighbours, and is totally destroyed by castration. The wedder is still more timid than the ram. It is fear alone that makes sheep so frequently assemble in troops: upon the smallest unusual noise, they run close together; and these alarms are always accompanied with the greatest stupidity. They know not how to fly from danger, and seem not even to be conscious of the hazard and inconvenience of their situation. Wherever they are, there they remain obstinately fixed; and neither rain nor snow can make them quit their station. To force them to move or to change their route, they must be provided with a chief, who is taught to begin the march: the motions of this chief are followed, step by step, by the rest of the flock. But the chief himself would also continue immoveable, if he were not pushed off by the shepherd, or by his dog, an animal which perpetually watches over their safety, which defends, directs, separates, assembles, and, in a word, communicates to them every movement necessary to their preservation.

"Of all quadrupeds, therefore, sheep are the most stupid, and derive the smallest resources from instinct. The goat, who so greatly resembles the sheep in other respects, is endowed with much more sagacity. He knows how to conduct himself on every emergency: he avoids danger with dexterity, and is easily reconciled to new objects. But the sheep knows neither how to fly nor to attack: however imminent her danger, she comes not to a man for assistance so willingly as the goat; and to complete the picture of timidity and want of sentiment, she allows her lamb to be carried off, without attempting to defend it, or showing any marks of resentment. Her grief is not even expressed by any cry different from that of ordinary bleating."

The annotator upon this article in the Edinburgh translation of Buffon, denies the above to be the natural character of the animal. "All tame animals (he observes) lose a portion of that sagacity, dexterity, and courage, which they are obliged to employ against their enemies in a wild state; because they have been long accustomed to rely upon the protection of man. Sheep, when enslaved by men, tremble at the voice of the shepherd or his dog. But, on those extensive mountains where they are allowed to range without controul, and where they seldom depend on the aid of the shepherd, they assume a very different mode of behaviour. In this situation, a ram or a wedder boldly attacks a single dog, and often comes off victorious. But when the danger is of a more alarming nature, like man, they trust not to the prowess of individuals, but have recourse to the collected strength of the whole flock. On such occasions, they draw up into one compact body; they place the young and the females in the centre; and the strongest males take the foremost ranks, keeping close by each others sides. Thus an armed front is presented on all quarters, which cannot be attacked without the greatest hazard of destruction. In this manner, they wait, with firmness and intrepidity, the approach of the enemy. Nor does their courage fail them in the moment of attack. For, if the aggressor advances within a few yards of the line, the ram darts upon him with such impetuosity, as lays him dead at their feet, unless he saves himself by flight. Against the attacks of single dogs, or foxes, they are, when in this situation, perfectly secure. Besides, a ram, regardless of danger, often engages a bull, and never fails to conquer him; for the bull, by lowering his head, without being sensible of his defenceless condition, receives between his horns the stroke of the ram, which usually brings him to the ground.

*Ibid.* p. 464, notes.

"In the selection of food, few animals discover greater sagacity than the sheep; nor does any domestic animal show more dexterity and cunning in its attempts to elude the vigilance of the shepherd, and to steal such delicacies as are agreeable to its palate. When perfectly tamed, and rendered domestic, the sportive gambols and troublesome tricks of the animal, are too well known to require any description."

As to the accusations contained in the latter part of the character above quoted, every person, it is observed,

Ovis.

ved, who has attended to those animals, at least in this country, must know that they are not altogether just.

Ibid. p. 466. notes.

"Individuals, in a state of subjection, seem to have no idea of resisting the attacks of an enemy. But they soon learn that their protection lies in the shepherd or his dog: for, when it becomes necessary, in Britain, to watch the folds, in order to prevent assaults from foxes or dogs, upon the first alarm the whole flock run with violence to the place where the watchmen are stationed; so that, when they chance to sleep, they are often hurt by the sheep trampling upon them. On other occasions, they never choose to make a very close approach either to men or dogs; but the sense of immediate danger makes them forget their usual timidity, and their sagacity teaches them where their safety lies. When the female is robbed of her lamb, she bleats in a manner that strongly marks the anguish she feels. In the eagerness of her search, her eye-balls seem to start from their sockets; and her irregular and distracted motions, joined to the violence and constancy of her bleatings, are evident indications of the most pungent grief."

Ibid. p. 467. &c.

"These animals (continues the Count in the same captious style as before), so simple and dull in their intellect, are likewise very feeble in their constitution. They cannot continue long in motion. Travelling weakens and extenuates them. When they run, they pant, and soon lose their breath. The ardour of the sun is equally incommodious to them as moisture, frost, and snow. They are subject to many diseases, most of which are contagious. A redundancy of fat often kills them, and always renders the ewes barren. They bring forth with difficulty; frequently miscarry, and require more care than any other domestic animal."

Ibid. p. 468. notes.

To which the annotator answers, "This is unquestionably another exaggeration. The sheep, when nearly in a wild state, is a robust, active animal, and capable of enduring much fatigue without injury. But, when immersed in luxury, and pampered in rich pastures, like creatures of a higher nature, the sheep becomes overloaded with fat, and contracts diseases which are not natural to him: besides, no tamed animal requires or receives less assistance in bringing forth its young; for in those parts of Britain where the best sheep are bred, they are never housed, nor, during the lambing season, have any thing administered to them but their ordinary pasture. When in health, sheep have no occasion for water: in our northern climates, it is even injurious to them."

On the whole, many of Buffon's observations and assertions on this article appear to be hasty, and, we presume, very ill founded. Respecting sheep, the learned Count seems to have been strangely misinformed, or grossly prejudiced. We esteem him as a great and an ingenious man, but we do not think that the celebrity of a name can add strength to weakness, or make that be taken for granted on a bare assertion which wants proof, or which is contrary to experience, the boasted guide of modern philosophers. The *objections* and *accusations* of this great naturalist are well obviated by his learned translator. The great error of Buffon seems to lie in his considering sheep in a domestic state, and as they exist among us, without any reference to them in a state of nature, and without supposing or allowing their existence in such a state (A). That he was wrong in this respect, a very little reflection will convince us; and indeed his translator has shown it in a very ample manner, by recurring to facts, which is the only legitimate way of reasoning upon this or any subject of this nature. To set this matter in a still stronger point of view, however, we shall give the following account of the Siberian *argali*, or wild sheep, as it appeared in the 16th volume of a periodical work intitled *the Bee*; being extracted by a correspondent from the works of the celebrated naturalist Dr Pallas, who has paid particular attention to this part of his profession.

This accurate observer "found the *ovis fera*, or wild sheep, in all its native vigour, boldness, and activity, inhabiting the vast chain of mountains which run through the centre of Asia to the eastern sea, and the branches which it sends off to Great Tartary, China, and the Indies. This wild animal, which our learned naturalist declares to be the *musimon* of Pliny, and the *ophion* of the Greeks, is called *argali* by the Siberians, which means wild sheep: and by the Russians *kamennoi barann*, or sheep of the rocks, from its ordinary place of abode. It delights in the bare rocks of the Asiatic chain just mentioned, where it is constantly found basking in the sun; but it avoids the woods of the mountains, and every other object that would intercept the direct rays of the glorious luminary. Its food is the Alpine plants and shrubs it finds amongst he rocks. The argali prefers a temperate climate, although he does not disdain that of Asiatic Siberia, as he there finds his favourite bare rocks, sunshine, and Alpine plants; nay, he is even fonnd in the cold eastern extremity of Siberia and Kamtschatka; which plainly proves that nature has given a most extensive range to the sheep in a wild state, equal even to what she has given to man, the lord of the creation; a fact that ought to make us slow in believing the assertions not uncommon, which tend to prove the sheep a local animal; or at least that it must be confined to certain latitudes, to possess it in all its value.

"The argali loves solitude, or possibly perfect liberty, and therefore flees the haunts of all subduing man; hence it gradually abandons a country in proportion as it becomes peopled, if no unsurmountable obstacle obstructs its flight; insomuch that Dr Pallas thinks that nothing but the surrounding sea can account for the wild sheep being found in an inhabited island, as is sometimes the case. The ewe of the argali brings forth before the melting of the snow. Her lamb resembles much a young kid: except that it has a large flat protuberance in place of horns, and that it is covered with a woolly hair, frizzled, and of a dark grey. There is no animal so shy as the argali, which it is almost impossible to overtake on such

4 B 2 ground

(A) In his account of sheep this is literally true, though, for the purpose of supporting a favourite hypothesis, he does mention the *argali*, or, as he calls it, *mouflon*; and asserts that it is the parent of all the domestic varieties: but this, in our opinion, only makes his observations in this place more unaccountable at least, if not inconsistent. See below note (C).

ground as it keeps to. When purfued, it does not run ftraight forward, but doubles and turns like a hare, at the fame time that it fcrambles up and over the rocks with wonderful agility. In the fame proportion that the adult argali is wild and untameable, the lamb is eafily tamed when taken young, and fed firft on milk, and afterwards on fodder, like the domeftic fheep, as has been found on numerous experiments made in the Ruffian fettlements in thefe parts.

"This animal formerly frequented the regions about the upper Irtifh, and fome other parts of Siberia, where it is no longer feen fince colonies have been fettled in thefe countries. It is common in the Mongalian, Songarian, and Tartarian mountains, where it enjoys its favourite folitude or liberty. The argali is found likewife on the banks of the Lena, up as high as 60 degrees of north latitude; and it propagates its fpecies even in Kamtfchatka, as noticed before. The argali is alfo found in the mountains of Perfia, and is faid to obtain in the Kuril iflands in great fize and beauty. It purges itfelf in the fpring (like all the domeftic varieties of the fheep, when left at liberty to follow their inftinct) with acrid plants of the anemonoide kind, till milder plants fpring up, and fhrubs begin to fprout, which with Alpine plants conftitute its ufual food. It likewife frequents the falt marfhes which abound everywhere in Siberia; and even licks the falt efflorefcence that rifes on the ground, a regimen that fattens them up very quickly, and fully reftores the health, vigour, and flefh they had loft during winter, and during the purging courfe, which, together with the reftorative, is by the Almighty fo wonderfully dictated to the fheep fpecies, whether in a wild or tame ftate, if left to roam at large where the neceffary plants are to be found." Here, then, we have a variety of the fheep fpecies, which by fome indeed, and by Dr Pallas among others, is thought to be the parent of all our domeftic varieties, and which lives and propagates without any aid from man, and which on all occafions carefully fhuns him. That it is the parent fheep we are not convinced; that being an opinion which requires proof, and better proof than we prefume the abettors of it are able to produce.

Having given a figure of this animal (fee Plate CCCLXXI.), we fhall add the following defcription of it, taken likewife from the Bee. The argali is about the height of a fmall hart, but its make is much more robuft and nervous. Its form is lefs elegant than that of the deer, and its legs and neck fhorter. The male is larger than the female, and every way ftouter. Its head refembles that of a ram, with long ftraggling hairs about the mouth; but no beard. Its ears are rather fmaller than thofe of a ram. The horns are exactly reprefented in the Plate; they weigh in an adult fometimes 16 pounds. The tail is very fhort. The fummer-coat confifts of fhort hair, fleek, and refembling that of a deer. The winter-coat confifts of wool like down, mixed with hair everywhere an inch and an half long at leaft, concealing at its roots a fine woolly down, generally of a white colour. The colour of its coat was in general of a dark greyifh brown, with white tips to the longer hairs, and confifted of hair mixed with wool, of a dark iron grey. By accounts lately received from the Tfhutfki, the argali is found of a white colour on the continent of America, oppofite to their country. It is likewife of a whitifh colour at Kamtfchatka.

But independent of its manners or its mental qualities, this animal is of the moft extenfive utility to man. We are clothed by its fleece. The flefh is a delicate and wholefome food. The fkin, dreffed, forms different parts of our apparel; and is ufed for covers of books. The entrails, properly prepared and twifted, ferve for ftrings for various mufical inftruments. The bones calcined (like other bones in general), form materials for tefts for the refiner. The milk is thicker than that of cows, and confequently yields a greater quantity of butter and cheefe; and in fome places is fo rich, that it will not produce the cheefe without a mixture of water to make it part from the whey. The dung is a remarkably rich manure; infomuch that the folding of fheep is become too ufeful a branch of hufbandry for the farmer to neglect. Nature, in fhort, has given this animal nothing that does not redound to our benefit.

The ram is capable of generation at the age of 18 months; and the ewe can be impregnated when a year old. One ram is fufficient, according to Buffon, for 25 or 30 ewes; they have often been known indeed to beget 100 lambs in a fingle feafon. He ought to be large and well proportioned; his head fhould be thick and ftrong, his front wide, his eyes black, his nofe flat, his neck thick, his body long and tall, his tefticles maffy, and his tail long (B). White is the beft colour for a ram. The ewes whofe wool is moft plentiful, bufhy, long, foft, and white, are moft proper for breeders, efpecially when at the fame time they are of a large fize, have a thick neck, and move nimbly.

In this climate ewes fed in good paftures admit the ram in July or Auguft; but September or October are the months when the greateft part of our ewes, if left to nature, take the ram. They go with young about five months, and generally bring forth but one at a time, though frequently two: in warm climates they may bring forth twice in a year; but in Britain, France, and moft parts of Europe, only once. They give milk plentifully for feven or eight months. They live from 10 to 12 years: they are capable of bringing forth as long as they live, when properly managed; but are generally old and ufelefs at the age of feven or eight years. The ram, though he lives 12 or 14 years, becomes unfit for propagating when eight years old.

When

(B) Buffon fays, "he fhould be garnifhed with horns; for hornlefs animals, of which there are fome in our climates, are lefs vigorous and lefs proper for propagating." On this the annotator obferves, that "there are many breeds of fheep in which both males and females want horns; yet they are as vigorous as any of the fpecies. The largeft and fineft fheep in England have no horns. In fome counties, the inhabitants are perfectly unacquainted with horned fheep; in other places, a fheep without horns is as great a rarity as one with four or fix horns."

Ovis.

When the male lambs are not intended to be kept for propagation, but fattened for food, they ought to be castrated at the age of five or six months. This operation is performed two ways: in the one, an incision is made, and the testicles taken out; in the other, a ligature is tied tight round the scrotum, above the testicles, which soon destroys the vessels which nourish them. After castration they are called *wedders*.

The ram, ewe, and wedder, when one year old, lose the two foreteeth of the under jaw; six months afterwards, they lose the two foreteeth next to these; and at the age of three years, the teeth are all replaced. The age of a ram may likewise be discovered by his horns, which always appear the first year, and frequently as soon as he is brought forth. These horns uniformly acquire an additional ring every year, as long as the creature lives. The ewes commonly have no horns, but a kind of long protuberances in place of them: however, some of them have two and some four horns.

Ibid. p. 481. &c.

"It has been remarked by the ancients (says Buffon), that all ruminating animals have suet: But this remark, strictly speaking, holds only with regard to the sheep and goat: The suet of the wedder is more copious, whiter, drier, firmer, and better, than that of any other animal. Fat or grease is very different from suet; the former being always soft, while the latter hardens in cooling. The greatest quantity of suet is found about the kidneys; and the left kidney furnishes more than the right. There are also considerable quantities in the epiploon or web, and about the intestines; but it is not near so firm or good as that of the kidneys, the tail, and other parts of the body. Wedders have no other grease but suet; and this matter is so prevalent in their bodies, that their whole flesh is covered with it. Even the blood contains a considerable quantity of suet; and the semen is so charged with it, as to give that liquor a different appearance from that of other animals. The semen of men, of the dog, horse, ass, and probably of every animal which affords not suet, dissolves with cold; or, when exposed to the air, becomes more and more fluid from the moment it escapes from the body. But the semen of the ram, and perhaps of every animal that has suet, hardens and loses its fluidity with its heat.

"In the sheep, the taste of the flesh, the fineness of the wool, the quantity of suet, and even the size of the body, vary greatly in different countries. In France, the province of Berri abounds most in sheep. Those about Beauvais, and in some other parts of Normandy, are fatter and more charged with suet. They are very good in Burgundy; but the best are fed upon the sandy downs of our maritime provinces. The Italian, Spanish, and even the English wools, are finer than the French wool. In Poitou, Provence, the environs of Bayonne, and several other parts of France, there is a race of sheep which have the appearance of being foreign. They are larger, stronger, and better covered with wool than the common kind. They are likewise more prolific, producing frequently two lambs at a time. The rams of this race engender with the common ewes, and produce an intermediate kind. In Italy and in Spain, there are a great variety of races; but they ought all to be regarded as of the same species with our common sheep, which, though so numerous and diversified, extend not beyond Europe. Those animals with a long broad tail, so common in Asia and Africa, and which are called *Barbary sheep* by travellers, appear to be a species different from the ordinary kind, as well as from the Pacos and Lama of America.

"As white wool is most valued, black or spotted lambs are generally slaughtered. In some places, however, almost all the sheep are black; and black lambs are often produced by the commixture of white rams with white ewes. In France, there are only white, brown, black, and spotted sheep; but in Spain, there is a reddish kind; and in Scotland there are some of a yellowish colour. But all these varieties of colour are more accidental than those produced by different races; which, however, proceed from the influence of climate, and the difference of nourishment."

Respecting the varieties, or, as some will have it, the different species of sheep, there has been a great difference of opinion amongst the learned. Buffon, we find, in the above extract, if we understand him right, regards the variety of races in Italy and in Spain as of the same species with our common sheep: but he considers the Barbary sheep as a distinct species (c). Dr Pallas, the learned naturalist already quoted, in very

(c) How consistent this opinion is with that which makes the *argali* the parent sheep, we shall not pretend to determine. This hypothesis he brings forward in the end of the 7th volume of his natural history*, and as much of it as concerns the present subject we shall here insert. He concludes, from a strain of reasoning, strong and plausible at least, if not absolutely convincing, that "the temperature of the climate, the quality of the food, and the evils produced by slavery, are the three causes of the changes and degeneration of animals. The effects of each merit a separate examination; and their relations, when viewed in detail, will exhibit a picture of Nature in her present condition, and of what she was before her degradation.

* Edin. edit. 1780

"Let us now compare our pitiful sheep with the mouflon, from whom they derived their origin. The mouflon, which is the same with the argali, is a large animal. He is fleet as a stag, armed with horns and thick hoofs, covered with coarse hair, and dreads neither the inclemency of the sky, nor the voracity of the wolf. He not only escapes from his enemies by the swiftness of his course, but he resists them by the strength of his body, and the solidity of the arms with which his head and feet are fortified. How different from our sheep, who subsist with difficulty in flocks, who are unable to defend themselves by their numbers, who cannot endure the cold of our winters without shelter, and who would all perish, if man withdrew his protection? In the warmest climates of Asia and Africa, the mouflon, who is the common parent of

Ovis. very extensive travels in the Russian empire, more particularly in Siberia, and amongst the pastoral nations of great Tartary, found what he regards as only one species of sheep subdivided into four varieties, and distinguished by their tails, the form of their heads, their ears and fleece. So that he condemns as unfounded and fanciful the erroneous idea of making *specific* differences of the accidental varieties, which, in his opinion, education Ovis.

all the races of this species, appears to be less degenerated than in any other region. Though reduced to a domestic state, he has preserved his stature and his hair; but the size of his horns are diminished. Of all domestic sheep, those of Senegal and India are the largest, and their nature has suffered least degradation. The sheep of Barbary, Egypt, Arabia, Persia, Calmuck, &c. have undergone greater changes. In relation to man, they are improved in some articles, and vitiated in others: But, with regard to nature, improvement and degeneration are the same thing; for they both imply an alteration of original constitution. Their coarse hair is changed into fine wool. Their tail, loaded with a mass of fat, has acquired a magnitude so incommodious, that the animals trail it with pain. While swollen with superfluous matter, and adorned with a beautiful fleece, their strength, agility, magnitude, and arms, are diminished: These long-tailed sheep are only half the size of the mouflon. They can neither fly from danger, nor resist the enemy. To preserve and multiply the species, they require the constant care and support of man.

"The degeneration of the original species is still greater in our climates. Of all the qualities of the mouflon, our ewes and rams have retained nothing but a small portion of vivacity, which yields to the crook of the shepherd. Timidity, weakness, resignation, and stupidity, are the only melancholy remains of their degraded nature. To restore their original size and strength, our Flanders sheep should be united with the mouflon, and prevented from propagating with inferior races; and, if we would devote the species to the more useful purposes of affording us good mutton and wool, we should imitate some neighbouring nations in propagating the Barbary race of sheep, which, after being transported into Spain, and even into Britain, have succeeded very well. Strength and magnitude are male attributes; plumpness and beauty of skin are female qualities. To obtain fine wool, therefore, our rams should have Barbary ewes; and to augment the size, our ewes should be served with the male mouflon."

The learned Count seems to speak with more certainty upon this subject than the circumstances of the case, or the nature of the facts (as yet far from being fully ascertained, or completely authenticated), will admit. The editor of the Bee, who is well known to have devoted much time and attention to this subject, thus ably exposes the futility of those arguments which are brought in support of an hypothesis, which he thinks extremely absurd, or at least premature. "Buffon (says he), who is the least scrupulous of all modern naturalists, has been the most forward to decide in this, as in many other cases. He does not so much as condescend to admit that there can be a doubt in this case; but on all occasions assumes it as a certainty, that all the varieties of one species have been derived from one parent; and boldly raises upon that supposition many practical inferences, which, if his theory should prove to be unfounded, might lead to very important errors; so that it is not a matter of idle curiosity to investigate this question." He then goes on to show, by some particular instances, the gross absurdity of Buffon's opinion. "Were (continues he) these diversities only casual, and apt to vary, it might be more easy for us to give faith to the hypothesis; but this is not the case. Experience hath fully proved, that any one breed may be kept perfectly uncontaminated for any length of time, with all its distinctive peculiarities entire, merely by preventing an intermixture by copulation. Nor is this all: it is also known, that if such intermixture be permitted, the descendants will undoubtedly be a mixed breed, evidently participating of the qualities and appearances of both their parents. Between a hound and a greyhound, a mongrel breed is obtained which possesses the sense of smelling, though in a less degree than the one, and the faculty of fleetness in a less degree than the other, of its parents; and its whole external appearance evidently indicates at first sight the compound of the stock whence it has descended. But let a small lap dog and a large mastiff be fed with the same food and tended with the same care, the one discovers no symptoms of increasing in size or diminishing it more than the other. Let them be carried from one country to another, they equally preserve their original distinctive qualities, without any farther change than the climate may perhaps produce; which equally seems to affect all the varieties of this animal. Never was there adopted an hypothesis more truly absurd than that of Buffon in this respect. Nor was there ever made such a barefaced attempt to try how far the credulity of mankind could lead them astray in deference to a great name, in direct contradiction to facts which fall immediately under the cognisance of every man who pleases but to open his eyes, and look right before him, as in those bold and unfounded assertions which he has been pleased to make, with regard to the transformation of dogs from one variety to another. Yet these opinions have been inadvertently transcribed many times by learned naturalists, without one symptom of doubt or hesitation. But can any thing be more contrary to reason, exeperience, and facts, that every man has before his eyes every day in his life, than such opinions? It is indeed humiliating for the pride of man, who plumes himself on the superiority of reason, to remark this. And it is mortifying for modern philosophy, which affects to be founded on experience and accurate observation of facts alone, to point out such things; but truth ought in all cases to be adhered to.' Though this note has already extended to an undue length, we cannot omit the following observations by the same patriotic writer: "In regard to sheep, the varieties of this useful class of animals seem to be considerable, and their natural propensities so discriminated as to be admirably calculated for adapting them to different situations on this globe, so as to make them a very universal inhabitant of it: and these are so diversified as to habits and instincts, as

Ovis education or mode of life, climate, food, and crossing the breed, have produced in sheep, as in other animals; and, in conformity to this opinion, he considers not only those varieties found in Europe, but also those of other quarters of the globe, as only accidental varieties of the same species; and his opinion is confirmed, by finding that they produce a prolific race though the breed be ever so much crossed; which he thinks would not be the case were they different species. The varieties which Dr Pallas examined, which, as we have already said, are four, are as follow. The first is named both by the Tartars and Russians *Tscherkessian* sheep, and by Pallas *dolichura* or long-tailed: it is the *ovis longicauda* of authors.

The second is called the Russian sheep by the natives, and by Pallas *brachiura* or short-tailed: it seems to be the *ovis Islandicus* of authors, with smaller horns.

The third has no fixed trivial name, as its appellations are as various as the provinces where it is reared; Pallas has called it *steatopyga* or fat-tailed: it is the *ovis lauticadata* of authors.

The fourth has likewise no fixed trivial name, but Pallas has called it *bucharian*, from finding it reared by the Bucharian Tartars in immense flocks. The Tscherkessian sheep, or first variety, is a handsome animal, with a noble air, in its native country and the south of Russia, resembling in its habits, horns, fleece, and length of tail, the Spanish, but more particularly the English sheep, Its head is well proportioned, and of an elegant form; ears straight; horns large, even, rounded in the angles, tapering to a point, and bending inwardly towards the back. The rams are seldom without horns, and the ewes have them often bent in a lunar form. The wool, though coarse, is without admixture of hair, which is perhaps but an accidental distinction, and promises to be much meliorated by crossing the breed, and rearing the animal with more care and skill. It is even known to become much finer without the assistance of art, merely from the influence of a temperate climate, as on mount Caucasus. The tail of the ram is covered with fine long wool, like the Indian sheep described by Buffon, which trails on the ground, so as to efface the prints made by the animal's feet on sand, and it contains often 20 joints or vertebræ. In passing from the state of nature to that of servitude it seems to have lost its native ferocity, together with its coarse fleece. Dr Pallas says it is a mild gentle animal, and is less *degenerated in form* from the argali, which, according to his system, is the parent species, than the steatopyga, which on the other hand has preserved much more of its wildness than the Tscherkessian; perhaps because it is allowed to range with little restraint on the wide extended plains of Great Tartary. The Tscherkessian is reared in all the European regions of the Russian empire, situated on this side the river Occa, in the nearer Poland, and by the pastoral people of mount Caucasus; and they are commonly of a white colour. Ovis.

The same variety, we are told by Russel, in his natural history of Aleppo, is reared under the name of *Bedouin sheep* by the Arabs, and in the western parts of Mauritania, with a trifling difference in the length and thickness of the tail. There are likewise sheep in Morocco, which belong to this variety, on account of the distinguishing character of it, a long tail, although otherwise different, in having an ugly look, head covered entirely with hair, little hanging ears, and remarkably long wool.

The Indian and Guinea sheep, so well described by Buffon, resemble the Tscherkessian only in the length of their tail, whilst in other respects they come nearer the steatopyga or fat-rumped sheep of Pallas in size, form, and fleece mixed with hair. The learned naturalist is of opinion, that the arid burning deserts produce this change on the wool; but his reasoning on this head is to us at least as little satisfactory as that by which he endeavours to prove the argali to be the parent species The inhabitants of Ukraine and Padoli carry on an extensive and valuable traffic with the skins of Tscherkessian sheep, the beauty of which they heighten in a very curious manner.

The *brachiura*, short-tailed, or second variety which Dr Pallas examined in his travels, is reared throughout all the north of Russia, and resembles that of Iceland in size, tail, and coarseness of fleece; but though this be the case in these few respects, yet it differs from it in a very essential character, that of *horns*, which are much smaller, and have nothing of that exuberance which Buffon and others attribute to the sheep of that island. It resembles the Tscherkessian sheep in the form of its head, straight upright ears, and in thickness of fleece; but the quality of the two fleeces are very different, this variety having wool almost as coarse as dog's hair: but the great distinguishing character between them is the tail, which is almost a quarter of a yard shorter than that of the Tscherkessian. The brachiura, or short-tailed sheep, is reared not only by the northern Russians, but likewise by the Fins and other neighbouring nations. Some of this variety have been transported into Siberia, where they have supported themselves on some pastures, though in poor condition; but through all the southern countries they are in less estimation than the long-tailed and fat-tailed varieties, which are much superior to them for size, fat, and good eating. The ewe of this short-tailed variety couples readily with the ram of the steatopyga or fat-tailed breed, and produces an animal nobler and larger than its mother, with a tail swelled at the base with fat, but meagre towards the end like that of the mixed breed, which makes Dr Pallas's fourth and last variety of domestic sheep. The ewe also couples clandestinely with the domestic

as to preserve the principal breeds very distinct, if left in a state of nature. The argali, strong, active, nimble, delights to live among rocks and inaccessible places; while the large sluggish breed of sheep, such as those that have been taken into keeping by our countryman Bakewell, could never ascend these steeps, but are well calculated to consume the produce of the fertile plains; there is therefore no chance that these two breeds would ever intermingle, if left entirely to themselves. The last of these two varieties has indeed been long domesticated by man, as being utterly incapable of withdrawing itself from his sway, though the first has been able to preserve its independence till the present hour in some of the mountains and least inhabited districts on the globe." He then goes on to mark the lesser distinctions, in which, however, we cannot follow him.

domeſtic he-goat, and produces an animal much reſembling the mother, but with a fleece of wool and hair. This latter is a fact of the truth of which we have ſome doubt. The Doctor may eaſily have been miſled, and may have adopted his opinion, merely from the ſhaggy appearance of the fleece of ſome breeds of ſheep, which much reſembles the hair of a goat; but theſe are found as well in countries where no goats exiſt, as in thoſe where they abound. The fact has not then, we think, been ſufficiently aſcertained. This variety ſupports extremely well the ſeverity of a northern climate; and Dr Pallas doubts not but it might paſs the winter in the plains of mountainous northern countries where there is not much ſnow; nay, he even thinks it might augment their hardineſs and ſtrength, if we are to judge from the habits and treatment of the Iceland flocks, ſo well deſcribed by Anderſon in his account of that iſland.

Dr Pallas remarked, that on mountainous paſtures expoſed to the ſun, ſuch as on the acclivity of the Ouralic chain, the Ruſſian or ſhort-tailed ſheep were larger, fatter, and had a finer fleece.

Croſſing the breed with the Tſcherkeſſian or long-tailed ſheep likewiſe mends both the ſtature and fleece of the brachiura; whereas, in its own natural ſtate, without admixture of other varieties of ſheep, it is but ſmall, lean, and produces, in the northern parts of Ruſſia, a wool ſo extremely coarſe as only to be fit for the cloth of peaſants in a ſtate of vaſſalage.

Whether coarſeneſs of wool and leanneſs be indeed characteriſtical marks of this ſpecies, is, we think, extremely doubtful: we are rather inclined to conſider them as mere accidental differences.

The Doctor's third variety, or *ſteatopyga*, which has a different name in almoſt every country where it is reared, is both the moſt abundant and largeſt breed of ſheep in the world. It is reared throughout all the temperate regions of Aſia, from the frontiers of Europe to thoſe of China, in the vaſt plains of Tartary. All the Nomade hordes of Aſia, the Turcomans, Kirguiſe, Calmucks, and Mongal Tartars, rear it; and indeed it conſtitutes their chief riches, the number they poſſeſs being enormous. The Perſians alſo rear it in abundance; as likewiſe the Hottentots, as we are informed by Kolbe in his Travels to the Cape of Good Hope; whilſt Oſbeck, in his Journey to China, aſſerts, that the fat-tailed ſheep are reared through that whole empire. We are alſo told by Shaw and the Abbe Demanent, that the ſame breed obtains in Syria, Mauritania, and the other regions of Africa, under ſome modifications of form, from different cauſes; ſo that Dr Pallas thinks there is ſufficient evidence that the ſteatopyga, or fat-rumped ſheep, is the moſt univerſally reared and multiplied of any breed in the world. The flocks of all the Tartar hordes reſemble one another by a large yellowiſh muzzle, the upper jaw often projecting beyond the lower; by long hanging ears; by the horns of the adult ram being large, ſpiral, wrinkled, angular, and bent in a lunar form. The body of the ram, and ſometimes of the ewe, ſwells gradually with fat towards the poſteriors; where a ſolid maſs of fat is formed on the rump, and falls over the anus in place of a tail, divided into two hemiſpheres, which take the form of the hips, with a little button of a tail in the middle, to be felt with the finger. See A fig. 16. plate CCCLXXI. The *uropygium* or fat-rump, which is made up of this oily ſpecies of fat, is ſo very large as to incommode the animal in walking; but when the ſame ſheep are carried into the interior parts of Ruſſia, the tail loſes half its ſize and weight, nay ſometimes more, from a change in their food and mode of life. This variety, beſides the characters mentioned above, have ſlender legs in proportion to their bodies, a high cheſt, large hanging teſticles, a large prepuce, and tolerably fine wool mixed with hair. Such are the great characteriſtic marks by which the flocks of all the Tartar hordes reſemble one another; but climate, ſoil, &c. produce ſome ſmall difference in this variety, whether reared by the Tartars or the Ruſſians, in the weſtern deſert of Great Tartary, from the river Volga to the Irtiſh, and the Altaic chain of mountains. In all that tract of country, the paſturage is moſtly arid; and it abounds in acrid and liliaceous plants in ſpring, whilſt in ſummer it produces, at leaſt in the open ſpots where ſheep delight to feed, beſides gramen, bitter and aromatic plants, artemiſia, camphoroſna, and many ſpecies of ſalſola, abounding in juices and ſalts. There is likewiſe found everywhere an efflorеſcence of natron, with ſea or glaubers ſalt; nay, even the waters of the deſert contain in general the ſame ſalts. Now it is almoſt unneceſſary to inform European ſhepherds, that ſuch paſturage has the effect of augmenting the ſize of ſheep, if it produces no other change upon them; ſo that we ſee, in this inſtance, how ſome kind of difference may ariſe amongſt ſheep of the ſame breed merely from accidental cauſes, without the leaſt admixture of heterogeneous blood. This variety changes greatly in ſize and in other incidental circumſtances, according to the method of raiſing or of treating them in different places and by different people.

The fourth variety, raiſed by the Boucharian Tartars and Perſians in great numbers, Dr Pallas regards as a mixed breed, ariſing, as he ſuppoſes, from the union of the firſt and third varieties, *i. e.* of the long and fat-tailed ſheep. The Doctor does not think that they ever attain to the ſize of either of their parents; though, as he never ſaw any full grown, he does not ſpeak poſitively upon the ſubject. The head of this variety is like that of the Kirguiſe; but the muzzle is ſharper, reſembling the Indian of Buffon: the body is rather ſmaller than that of the Kirguiſe ſheep: the ears are large and pendant: they have a ſmall uropygium, like that of the Tartar ſheep on the Jeniſy, eſpecially when begotten by a Kirguiſe ram: but in general they have a *tail* fat and broad at the baſe, with a long narrow appendage, which reſembles the tail of the Tſcherkeſſian ſheep. The Boucharian Tartars have a very valuable traffic with the furs of the lambs of this variety, which are exquiſitely fine and beautiful. This ſame variety is likewiſe raiſed in great numbers by the Perſians; and it is more than probable, if we are to give credit to authors ancient and modern, that this very variety obtains in Syria, Paleſtine, and divers countries of Africa, known to them by the name of *ovis macrocereus*. It differs in all thoſe countries from the fat-tailed, or ſteatopyga of Pallas, in having a long tail, fat and broad above, with a long narrow appendage, which is exactly the

Ovis. great marked character of the Boucharian breed. Pliny tells us, that the Syrian sheep have long fat tails, and carry wool; and by Ruffel's account of them, in his Natural History of Aleppo, they resemble the Kirguise sheep in the head, face, and ears hanging on the cheeks; but the tail is that of the Boucharian, fat above, with a long lean appendage. He adds, that they are covered with a soft wool, which is another trait of resemblance with our present variety; and that they weigh sometimes 150 pounds, one third of which is the weight of the tail. Gesner, in his work on quadrupeds, tells us, that the Arab sheep of Kay have nearly the same characteristic marks, especially with regard to the tail.

Shaw relates, in his Travels, that sheep with such a compound tail are common in Mauritania, and in all the East; whilst Kolbe assures us, that the sheep which are brought on board the ships at the Cape of Good Hope have tails weighing 25 or 30 pounds, fat above, with a bony appendage hanging from it; and, lastly, the Abbé Demanent, in his New History of Africa, says, that sheep are found in Africa covered with wool, and with such a tail as we have been describing; whilst at Cape Guarda, in the south of Africa, all the sheep are white, with rather small black heads, otherwise a large handsome breed, with broad fat tails, six or eight inches long.

The Doctor, however, does not entirely close his proofs here; for he quotes several passages from Moses in confirmation of what he has advanced, *viz.* that the Boucharian sheep obtain in Syria, Palestine, and divers countries of Africa. The passages he quotes are these: Leviticus viii. 25. ix. 19. But whether these verses prove what the Doctor has quoted them as proving, we will not determine.

These are the four varieties which Dr Pallas saw and examined in his extensive travels. The account is, we think, curious; to naturalists interesting; and to farmers it may be useful. If it only excite further research, and minuter inquiry, it will answer some purpose. Indeed, the man of science will not rest satisfied with what our prescribed bounds have permitted us to bring forward, but will recur to the original work of the learned author to whom we are primarily indebted for the above account. We refer such readers, then, to his *Spicilegia Zoologica, fasciculus undecimus*, printed at Berlin in 1776.

It may not be improper to describe the figures of these four varieties. They are all contained in Plate CCCLXXI. fig. 16. of which is the argali. Fig. 17. is a side and back view; letters A*a* of the ram of the steatopyga, or fat-rumped variety, in its greatest purity of breed, as obtaining among the Kirguise Tartars in the vast plains of Southern Tartary. The position of the animal marked with *a* shows the uropygium or fat-rump. Letter *b* is a representation of the head of the same animal, with a couple of noneola hanging from the neck, called by the Russians *earrings*. Letter C is a drawing of another Kirguise ram with five horns, shewing at same time the hanging position of the ears of this variety. Fig. 18. is a drawing of a degenerate breed of the steatopyga variety of sheep, reared on the banks of the Jenisy and Volga, without horns, and with the uropygium or fat rump greatly diminished, and one noneola. Letter *b* (fig. 19.) is a drawing of a ram of the same variety of sheep, from the flocks of the Jenisy Kirguise, with four horns symmetrically arranged by nature, as is frequently the case with this breed.

Ovis

In a supplement to his article Sheep Buffon has these words respecting the strepsiceros: "I here give figures," says the Count (see Plate CCCLXXI. fig. 14. and 15.) "of a ram and ewe, of which drawings were sent me by the late Mr Colinson, fellow of the Royal Society of London, under the names of the *Walachian ram* and *ewe*. As this learned naturalist died soon afterwards, I could not discover whether these sheep, whose horns are extremely different from those of the ordinary kind, be common in Walachia, or whether they are only an accidental variety (D).

*See above, p. 454, &c.*

"In the northern parts of Europe, as Denmark and Norway, the sheep are not good; but, to improve the breed, rams are occasionally imported from England. In the islands adjacent to Norway, the sheep remain in the fields during the whole year; and they become larger and produce finer wool than those which are under the care and direction of men. It is alleged, that those sheep which enjoy perfect liberty always sleep, during the night, on that side of the island from whence the wind is to blow next day. This natural indication of the weather is carefully attended to by the mariners *.

"The rams, ewes, and wedders of Iceland, differ chiefly from ours by having larger and thicker horns. Some of them have three, four, and even five horns. But this peculiarity of having more horns than two, must not be considered as common to the whole race of Iceland sheep; for in a flock of four or five hundred, hardly three or four wedders can be found with four or five horns, and these are sent to Copenhagen as rarities. As a farther proof of their being scarce, they give a higher price in Iceland than the common kind §."

* Pontopiddan's *Nat Hist. of Norway.*

§ *Hist. Gen. des Voyages*, t. 18. p. 19.

In Spain and the southern parts of Europe, the flocks of sheep are kept in shades or stables during the night: but in Britain, where there is now no danger from wolves, they are allowed to remain without, both night and day; which makes the animals more healthy, and their flesh a more wholesome food. Dry and mountainous grounds, where thyme and sheep's fescue grass abound, are the best for the pasturing sheep.

The sheep is subject to many diseases: some arising from insects which deposit their eggs in different parts of the animal; others are caused by their being kept in wet pastures; for as the sheep requires but little drink, it is naturally fond of a dry soil. The dropsy, vertigo (the *pendro* of the Welsh), the phthisis, jaundice, and worms in the liver, annually make great havock



(D) Dr Pallas thinks it very probable that the strepsiceros variety of sheep were produced by propagating a particular configuration of horns. He alludes to the animal which Bellonius first discovered on Mount Ida in Crete, and which he supposes the strepsiceros of the ancients.

vock among our flocks: for the first disease, the shepherds finds a remedy by turning the infected into fields of broom; which plant has been also found to be very efficacious in the same disorder among the human species.—The sheep is also infested by different sorts of insects; like the horse it has its particular œstrus or gad-fly, which deposits its eggs above the nose in the frontal sinuses (see OESTRUS); when those turn into maggots, they become excessively painful, and cause those violent agitations that we so often see the animal in. The French shepherds make a common practice of easing the sheep, by trepanning and taking out the maggot; this practice is sometimes used by the English shepherds, but not always with the same success. Besides these insects, the sheep is troubled with a kind of tick and louse, which magpies and starlings contribute to ease it of, by lighting on its back, and picking the insects off.

We had intended to have introduced into this article some observations from Pennant; but it has already extended beyond its just limits, and we dare not venture to extend it further. Under the article WOOL, which is intimately connected with the present, we may perhaps have an opportunity of introducing some additional remarks not without importance. At all events, we trust by that time to be able to give a favourable report of that truly patriotic society which has been lately instituted in this part of the united kingdom for meliorating the breed of sheep, and in consequence the nature and quality of the *wool*. From the active and indefatigable exertions of Sir John Sinclair, baronet, the president of that society, we have every thing to hope from well conducted experiments, and nothing to fear from groundless hypotheses.

OUNCE, a little weight, the 16th part of a pound avoirdupois, and the 12th part of a pound Troy. The word is derived from the Latin, *uncia*, "the twelfth part of any whole," called *as*; particularly in geometrical measures, an inch, or the 12th part of a foot. See INCH and AS.

OUNCE, in zoology. See FELIS.

OVOLO, or OVUM, in architecture, a round moulding, whose profile or sweep, in the Ionic and Composite capitals, is usually a quadrant of a circle: whence it is also commonly called the *quarter-round*. It is usually cut with representations of eggs and arrow-heads or anchors placed alternately.

OU-POEY TSE, a name given by the Chinese to a kind of nests made by certain insects upon the leaves and branches of the tree called *yen-fou-tse*. These nests are much used in dyeing, and the physicians employ them for curing many distempers. Some of these nests were brought to Europe, and put into the hands of the celebrated Mr Geoffroy. After having examined them with the utmost attention, this learned academician thought he perceived some conformity in them to those excrescences which grow on the leaves of the elm, and which the vulgar call *elm-bladders*: he found these nests so sharp and astringent to the taste, that he considered them as far superior to every other species of galls used by the dyers. According to him, they are the strongest astringents existing in the vegetable kingdom.

It is certain that there is a great affinity between the ou-poey-tse and the elm-bladders. The form of both is unequal and irregular; they are covered on the outside with a short down, which renders them soft to the touch; within they are full of a whitish-grey dust, in which may be observed the dried remains of small insects, without discovering any aperture thro' which they might have passed. These nests or bladders harden as they grow old; and their substance, which appears resinous, becomes brittle and transparent; however, the Chinese do not consider the ou-poey-tse, notwithstanding their resemblance to elm-bladders, as excrescences of the tree yen-fou tse, upon which they are found. They are persuaded, that insects produce a kind of wax, and construct for themselves on the branches and leaves of this tree (the sap of which is proper for their nourishment) little retreats, where they may wait for the time of their metamorphosis, or at least deposit in safety their eggs, which compose that fine dust with which the ou-poey-tse are filled. Some of the ou-poey-tse are as large as one's fist; but these are rare, and are generally produced by a worm of extraordinary strength, or which has associated with another, as two silk worms are sometimes seen shut up in the same ball. The smallest ou-poey-tse are of the size of a chesnut; the greater part of them are round and oblong; but they seldom resemble one another entirely in their exterior configuration. At first, they are of a dark green colour, which afterwards changes to yellow; and the husk, though pretty firm, becomes then very brittle.

The Chinese peasants collect these ou-poey-tse before the first hoar-frosts. They take care to kill the worm inclosed in the husks, and to expose them for some time to the steam of boiling water. Without this precaution, the worm might soon break through its weak prison, which would immediately burst and be useless. The ou-poey-tse are used at Pekin for giving a paper a durable and deep-black colour; in the provinces of Kiang nan and Tche-kiang, where a great deal of beautiful sattin is made, they are employed for dyeing the silk before it is put on the loom. The Chinese literati also blacken their beards with them when they become white.

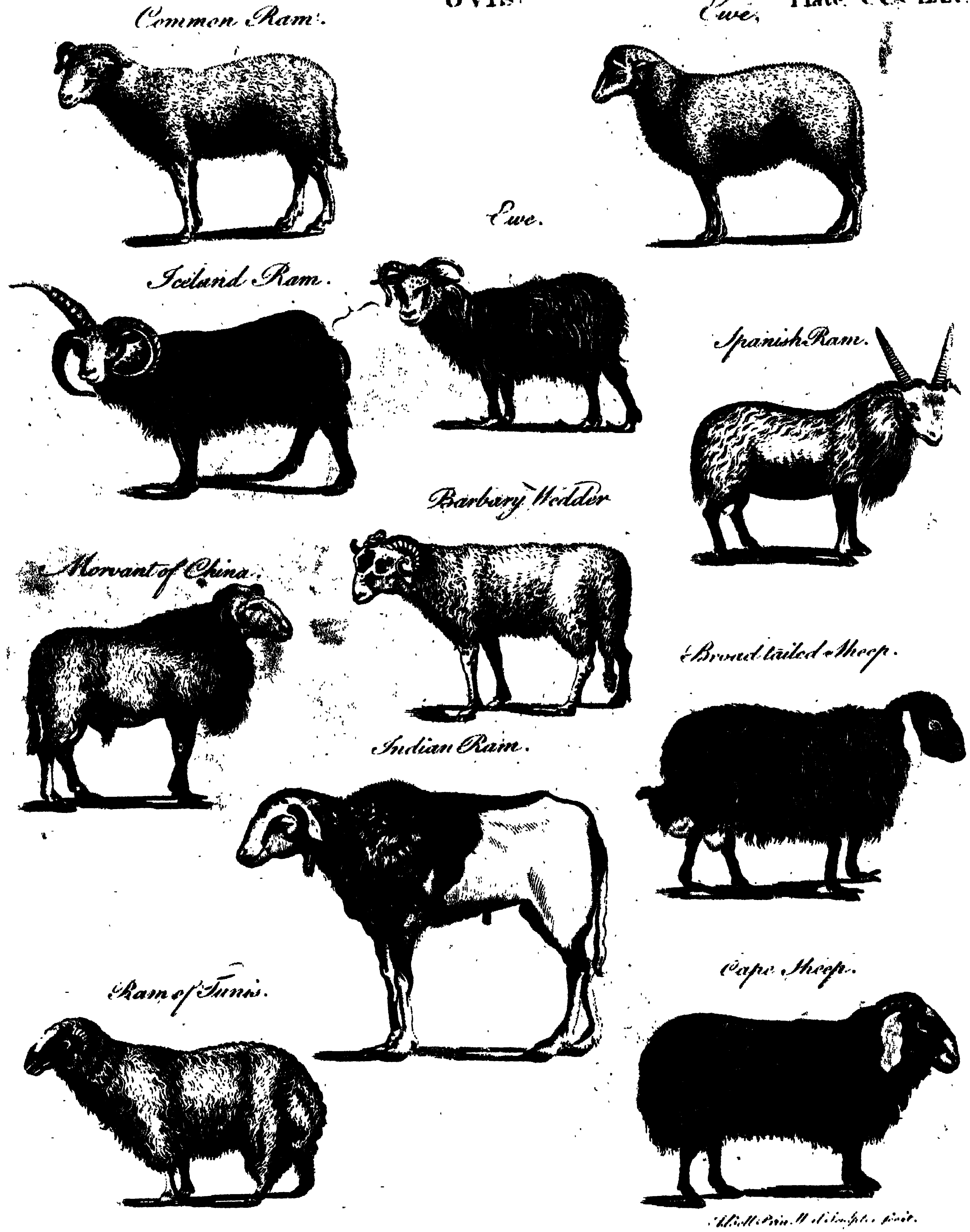
The medicinal properties of the ou-poey-tse are very numerous. The Chinese physicians introduce them into the composition of many of their remedies. They recommend them for stopping bloodings of every kind; they consider them as an excellent specific for curing inflammations and ulcers, and for counteracting the effects of poison; and they employ them with success in the dropsy, phthisis, epilepsy, catarrhs, sickness, fluxions of the eyes and ears, and in many other disorders.

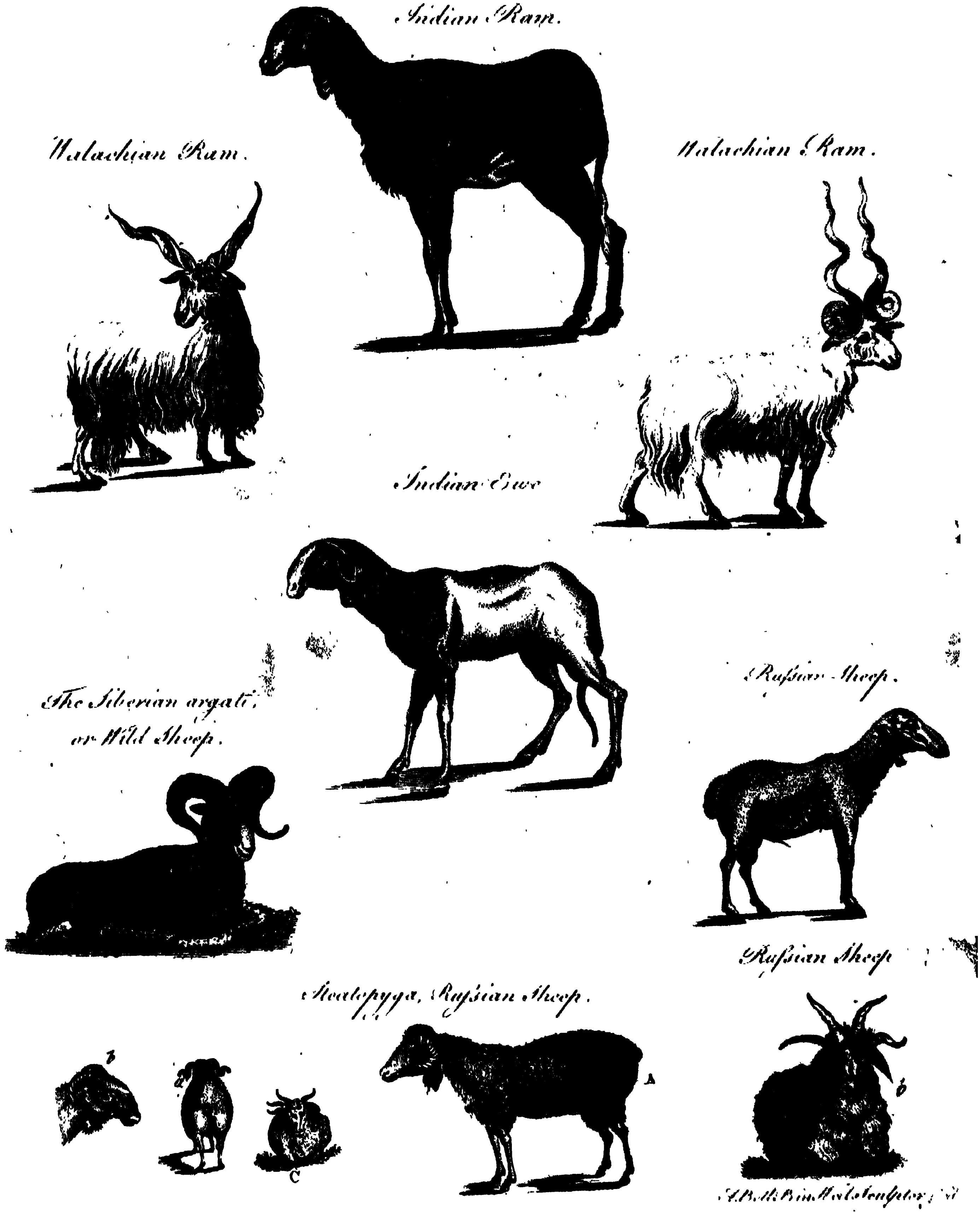
GREATER OUSE, a river which rises near Fitwell in Oxfordshire, and proceeds to Buckingham, Stony-Stratford, and Newport-Pagnel, in Buckinghamshire; from thence it proceeds to Bedford, and turning north-east it passes on to Huntingdon and Ely, till at length it arrives at Lynn-Regis in Norfolk, and falls into the sea. It is navigable to some distance above Downham, where there is a good harbour for barges; and a considerable trade is carried on by it to Lynn and other towns.

*Smaller* OUSE, rises in Suffolk, and, separating that county from Norfolk on the south-west, discharges itself into the great Ouse near Downham. There is still another of the same name which rises in the west-

north-

OVIS. Plate CCCLXX.




Indian Ram.
Walachian Ram.
Walachian Ram.
Indian Ewe
The Siberian argali,
or Wild Sheep.
Russian Sheep.
Russian Sheep
Steatopyga, Russian Sheep.
A
b
c

north-west side of Yorkshire; and chiefly running to the south-east, at length falls into the Humber.

OUSTER, or DISPOSSESSION, in law, an injury which carries with it the amotion of possession; for by means of it the wrong doer gets into the actual possession of the land or hereditament, and obliges him that hath a right to seek a legal remedy, in order to gain possession, together with damages. This ouster may either be of the freehold by abatement, intrusion, disseisin, discontinuance, and deforcement; or of chattels real, as an estate by statute-merchant, statute-staple or elegit, or an estate for years.

*Ouster le Main*, *amovere manum*, in law, denotes a livery of lands out of the king's hands; or a judgment given for him that traversed, or sued, a *monstrans le droit*. When it appeared, upon the matter being discussed, that the king had no right or title to the land seized, judgment was given in chancery, that the king's hand be amoved; and *ouster le main*, or *amoveas manum*, was therefore awarded to the escheator, to restore the land, &c. All wardships, liveries, *ouster le mains*, &c. are now taken away and discharged by statute 12. Car. II.

OUSTIOUG, a town of the Russian empire, and capital of a province of the same name, with an archbishop's see and a castle; seated on the river Suchan, over-against the mouth of the Jug, in E. Long. 43. 25. N. Lat. 61. 48.

OUSTIOUG, a province of the Russian empire, bounded on the north by Dwina, on the east by the forest of Zirani, on the south by Wologda, and on the west by Cargapol and Waga. It is divided into two parts by the river Suchana; is full of forests; and the rivers yield plenty of fish, which the inhabitants dry in the sun, and which make their principal nourishment.

OUT-POSTS, in a military sense, a body of men posted beyond the grand guard; called *out-posts*, as being the rounds or limits of the camp.

OUTLAW, signifies one that is deprived of the benefit of the law, and therefore held to be out of the king's protection.

Bracton asserts, that an outlaw forfeits all he has; and that, from the time of his outlawry, he wears a wolf's head; and any body may kill him with impunity, especially if he defend himself or fly. But in Edward III.'s time it was resolved by the judges, that it should not be lawful for any man, but the sheriff alone (having sufficient warrant for it), to put to death a man that was outlawed.

OUTLAWRY, the punishment of a person who, being called into law, and lawfully, according to the usual forms, sought, does contemptuously refuse to appear.

The effect of being outlawed at the suit of another, in a civil cause, is the forfeiture of all the person's goods and chattels to the king, and the profits of his land, while the outlawry remains in force. If in treason or felony, all the lands and tenements which he has in fee, or for life, and all his goods and chattels, are also forfeited; and besides, the law interprets his absence as a sufficient evidence of guilt; and without requiring farther proof, accounts the person guilty of the fact, on which ensues corruption of blood, &c. And then, according to Bracton, he may perish without law, &c. However, to avoid inhumanity, no man is intitled to kill him wantonly or wilfully; but in so doing he is guilty of murder, unless it happens in endeavouring to apprehend him; for any body may arrest an outlaw, either of his own head, or by writ or warrant of *capias utlagatum*, in order to bring him to execution.

If after outlawry, in civil cases, the defendant publicly appear, he is to be arrested by a writ of *capias utlagatum*, and committed till the outlawry be reversed: which reversal may be had by the defendant's appearing in court (and in the king's-bench, by sending an attorney, according to statute 4 and 5 W. and M. cap. 18.), and any plausible circumstance, however trifling, is in general sufficient to reverse it; it being considered only as a process to force appearance. The defendant must, however, pay full costs, and must put the plaintiff in the same condition as if he had appeared before the writ of *exigi facias* was awarded. It is appointed by magna charta, that no freeman shall be outlawed, but according to the law of the land. A minor or a woman cannot be outlawed.

In Scotland outlawry anciently took place in the case of refusal to fulfil a civil obligation, as well as in criminal cases. At present, however, it only takes place in the two cases of flying from a criminal prosecution, and of appearing in court attended by too great a number of followers. But the defender, upon appearing at any distance of time and offering to stand trial, is intitled *de jure* to have the outlawry reversed, and to be admitted to trial accordingly, and even to bail if the offence be bailable. See WAIVE.

OVUM ANGUINUM. See ANGUINUM.

OUTWORKS, in fortification, all those works made without side the ditch of a fortified place, to cover and defend it. See FORTIFICATION.

OUZEL, in ornithology; a species of MOTACILLA.

OWEN (Thomas), a judge of the common-pleas, son of Richard Owen, Esq; of Condover in Shropshire, was educated at Oxford, and, as is generally supposed, at Christ-church college. Having taken a degree in arts, he left the university, and entered himself of Lincoln's inn in London, where in process of time he became an eminent counsellor. In 1583 he was elected Lent reader to that society. In 1590 he was made serjeant at law, and queen's serjeant soon after. He arrived at length at the dignity of judge of the common pleas; which office he is said to have executed, during five years, with great abilities and integrity. He died in 1598; and was buried on the south side of the choir in Westminster abbey, where a monument was erected to his memory. He had the reputation of a learned man, and a patron of literature. He was the author of "Reports in the common pleas, wherein are many choice cases, most of them thoroughly argued by the learned serjeants, and after argued and resolved by the grave judges of those times, with many cases wherein the difference of the year-books are reconciled and explained." Lond. 1656, folio.

OWEN (Dr John), an eminent and learned dissenting minister, was born in 1616, at Hadham, in Oxfordshire, of which place his father was vicar. He made such surprising proficiency in learning, that at twelve years of age he was admitted into Queen's-college, Oxford, and in 1635 was made master of arts: but soon after, disapproving the new regulations made by Archbishop Laud their chancellor, with which he

Owen.

refused to comply, he was obliged, in 1637, to leave the university; when, taking orders, he became chaplain to Sir Robert Dormer of Ascot in Oxfordshire, and was at the same time tutor to his eldest son. He was afterwards chaplain to John Lord Lovelace of Hurley in Berkshire; when the civil war broke out, he openly avowed the cause of the parliament; which was so resented by an uncle, who had intended to leave him his estate, that he discarded him, and left it to another. Yet though Lord Lovelace sided with the king, he treated his chaplain with great civility: but on his going to join the royal army, Mr Owen went to London, and soon after joined the non-conformists. In 1642 he published his book, intitled, *A Display of Arminianism*, which laid the foundation of his future advancement: for the committee for purging the church of scandalous ministers were so pleased with it, that Mr White their chairman sent him a presentation of the living of Fordham in Essex: but when he had been there about a year and a half, the patron hearing that the sequestered incumbent was dead, presented another to the living; upon which the Earl of Warwick gave Mr Owen the living of Coggeshal. He had not, however, been long at that town before he left the Presbyterians; and, joining the Independents, formed a church there. He was now sent for several times to preach before the parliament; and among the rest on the 28th of February 1648-9, the day of humiliation for the intended expedition to Ireland. Cromwell, who was present at this last discourse, and had never heard him before, was extremely pleased with it, and desired his company into Ireland, and that he would reside in the college of Dublin. This he did; but returned in about half a year. Soon after Cromwell sent him into Scotland; but he also returned from thence after about half a year's stay at Edinburgh. He was then promoted to the deanery of Christ-church, Oxford, whither he went in 1651; and Cromwell, being now chancellor of the university, nominated him his vice-chancellor. The next year he was created doctor of divinity by diploma. Dr Owen enjoyed the post of vice chancellor five years; during which he behaved with the greatest moderation; for, though often solicited, he never molested the meeting of the royalists at the house of Dr Willis the physician, where divine service was performed according to the liturgy of the church of England: and though he was a commissioner for ejecting scandalous ministers, he frequently overruled his brethren in favour of those royalists who were distinguished by their merit. At the death of Cromwell, he was removed from the vice-chancellorship; and at the Restoration was ejected from his deanery of Christ-church. But he had provided himself a comfortable retreat at an estate he had purchased at Hadham. He now employed himself in preaching as often as he had an opportunity, and in writing books; one of which, intitled *Fiat Lux*, falling into the hands of Lord Clarendon, he was so pleased with it, or (as is said) from policy pretended to be so, that he sent for Dr Owen, and acknowledging the service he had done by it to the Protestant religion, offered to prefer him in the church if he would conform; but he desired to be excused.—His moderation drew him respect from persons of opposite principles; and in the number of his friends were Dr Wilkins bishop of Chester, and Dr Barlow bishop of London. He died at Ealing in 1683. His works are printed in seven volumes folio.

Wood, after censuring him in many respects, says nevertheless, that, "to speak impartially, he was a person well skilled in the tongues, Rabbinical learning, and Jewish rites and customs; that he had a great command of his English pen, and was one of the genteelest and fairest writers who have appeared against the church of England."

Owhyhee.

OWHYHEE, the easternmost, and by far the largest, of the Sandwich Islands. Its greatest length from north to south is 28½ leagues, its breadth 24, and its circumference nearly 300 English miles. It is divided into six large districts; two of which on the north-east side are separated by a mountain, that rises in three peaks, which is perpetually covered with snow, and may be seen clearly at 40 leagues distance. To the north of this mountain, the coast consists of high and steep cliffs, down which fall many beautiful cascades of water. The whole country is covered with cocoa-nut and bread-fruit trees. The peaks of the mountain on the north east side appear to be about half a mile in height, and entirely covered with snow. To the south of this mountain, the coast presents a prospect of the most dreary kind, the whole country appearing to have undergone a total change by means of some dreadful convulsion. The ground is everywhere covered with cinders, and intersected in many places with black streaks, which seem to mark the course of a lava that has flowed not many ages since from the mountain to the shore. The southern promontory looks like the mere dregs of a volcano. The projecting headland is composed of broken and craggy rocks, piled irregularly one upon another, and terminating in sharp points; yet amidst these ruins, there are many pieces of rich soil, which are carefully out in plantations, and the neighbouring sea affords a vast variety of excellent fish: so that this quarter is much better inhabited than those which are more verdant. The fields are inclosed with stone fences, and are interspersed with groves of cocoa nut trees. We are told indeed by some of Cook's people who was through a considerable part of it, that they did observe a spot of ground that was susceptible of improvement left unplanted; and indeed the country from their account, could scarcely be cultivated to greater advantage for the purposes of the natives. They were surprised at seeing several fields of hay; and upon their inquiry, to what particular use it was applied, they were informed, that it was intended to cover the grounds where the young taro grew, in order to preserve them from being scorched by the rays of the sun. They observed among the plantations a few huts scattered about, which afforded occasional shelter to the labourers; but they did not see any villages at a greater distance from the sea than four or five miles. Near one of them, which was situated about four miles from the bay, they discovered a cave forty fathoms in length, three in breadth, and of the same height. It was open at each end; its sides were fluted as if wrought with a chisel; and the surface was glazed over, perhaps by the action of fire. There are supposed to be on this island about 150,000 inhabitants. So long as the name of Captain Cook shall

be

Owhyhee. be remembered, this island will not be forgotten; for he here fell a victim to a strange concatenation of events. See Cook.

We have the following account of the inhabitants of this island in Ellis's Authentic Narrative, &c. "The men are above the middle size, stout, well made, and fleshy, but not fat. Corpulency is not altogether so great a mark of distinction in these as in the Society Isles; and tallness, for which the Otaheiteans have great partiality, is also overlooked. Their colour is in general brown olive. The women are in general masculine, though there are some delicately made, and the voice of them all is soft and feminine. The hair both of the head and beard is black; that of the head the men wear in the form of a helmet, that is, a long frizzled ridge from the forehead to the neck, the sides being much shorter. This fashion seems to prevail only among the principal people, that of the inferior sort being of an equal length in every part. Most of them were very desirous of parting with their beards, which, they said, were disagreeable and troublesome, and were fond of being shaved by our people. Some of the priests wore their beards long, and would not on any account part with them. The women wear their hair long before, but very short behind, which is not the most becoming mode; and, like those of the Friendly Isles, they have a way of rendering it of different colours, red, yellow, and brown. The features of both sexes are good, and we saw some of the females who might really be called fine women. Their teeth are even and perfectly white. In general, they seem to be very healthy, and we observed several who appeared to be of great age. As to diseases, we saw none who laboured under any during our stay except the venereal complaint; coughs and colds indeed were pretty general, and one man died. From what we could learn of his disorder from the natives, it was a violent griping or colic.

"Both men and women appeared to be of a good disposition, and behaved to each other with the tenderest regard: when they did fall out, which sometimes was the case, occasioned by the upsetting of a canoe, or some such trifling accident, they only scolded a little, and this was soon over and forgotten. We never saw them strike each other upon any occasion. They are all thieves, from the aree to the towtow, but not quite so expert at it as our Otaheitee friends.

"The custom of tattowing prevails greatly among these people, but the men have a much larger share of it than the women; many (particularly some of the natives of Mow'whee) have one half their body, from head to foot, marked in this manner, which gives them a most striking appearance. It is done with great regularity, and looks remarkably neat: some have only an arm marked in this manner, others a leg; some again have both arm and leg, and others only the hand. The women are the most part marked upon the hand, and some upon the tip of their tongue; but of these we saw but few. Both sexes have a particular mark according to the district in which they live; or it is rather the mark of the aree, or principal man, under whose jurisdiction they more immediately are. We never saw the operation of tattowing performed, nor could we procure a sight of the instruments used upon this occasion; but it is likely they are much the same as those of the Friendly and Society Isles.

Owhyhee.

"Both men and women are very cleanly in their persons; the latter wash their whole bodies in fresh water twice and sometimes three times a-day; but the women of Otaheitee have the advantage of them in one point of cleanliness, which is eradicating the hairs from under the arm pits. This is a custom we observed nowhere but at the Society Isles.

"There are no people in the world who indulge themselves more in their sensual appetite than these: in fact, they carry it to a most scandalous and shameful degree, and in a manner not proper to be mentioned. The ladies are very lavish of their favours; but are far from being so mercenary as those of the Friendly or Society Isles, and some of their attachments seemed purely the effect of affection. They are initiated into this way of life at a very early period; we saw some who could not be more than ten years old.

"Their clothing consists of cloth of different kinds: that worn by the men, which is called *marro*, is about half a yard wide, and four yards long; that of the women three quarters of a yard wide, and of the same length as the mens: this they call *pah-oouwa*; they both wear it round their middle, but the men pass it between their legs. This is the general dress of both sexes; but the better sort sometimes throw a large piece loosely over their shoulders. Besides the marro, they have several other kinds of cloth, which derive their names either from the different uses they are applied to, or their different texture and pattern; all, however, as far as we could learn, are made from the Chinese paper mulberry tree. The principal of these is the cappa, which is about 10 or 12 feet long, and nearly as many wide, and is thick and warm; they wrap themselves up in this when they retire to sleep. They have another kind, which is white, and much thinner; this, as has been before observed, they throw loosely over their shoulders; it is sometimes 20 or 30 yards long, and wide in proportion. The marro and pah oouwa are curiously painted of various patterns, but the others are generally white, or dyed red, black, and yellow.

"The principal ornaments of the men are the feather-caps and cloaks; some of the latter reach down to their heels, and have a most magnificent appearance. They are made for the most part of red and yellow feathers, which are tied upon fine net-work. The caps are composed of the same kind of feathers, which are sometimes intermixed with black; they are secured upon a kind of basket-work, made in the form of a helmet. Both caps and cloaks are made of various patterns and sizes. The cloaks are not all composed of the same kind of feathers, but are sometimes varied with the long tail-feathers of the cock, with a border of yellow or red, and sometimes with those of the tropic bird. Both caps and cloaks, however, are only to be seen in the possession of the principal people. They have also a kind of fly-flap, made of a bunch of feathers fixed to the end of a thin piece of smooth and polished wood: they are generally made of the tail-feathers of the cock, but the better sort of people have them of the tropic birds feathers, or those belonging

ing to a black and yellow bird called *mohó*. The handle is very frequently made of one of the bones of the arm or leg of those whom they have killed in battle, curiously inlaid with tortoise-shell: these they deem very valuable, and will not part with them under a great price. This ornament is common to the superiors of both sexes.

"The women too have their share in the ornamental way: that which they value most is the orài. This is a kind of ruff or necklace, made of red, green, black, and yellow feathers, curiously put together, and in most elegant patterns, which really do honour to the fancy of the ladies, whose business it is to make them. They never think themselves dressed without one or two of these round their necks, and those who can afford it wear many. Others again are composed of small variegated shells, disposed in a very neat manner; and some consist of several rows of twisted hair, with a piece of carved wood or bone, highly polished, the bottom part forming a curve. The higher the quality of the wearer, the greater is the size of the wood or bone, and the quantity of the twisted hair. The next thing is the poo-remah or bracelet; the most valuable are made of boar's tusks fastened together side by side with a piece of string, by means of a hole drilled through the middle; the larger the tusks, the greater the value. Sometimes two shells tied round the wrists with twisted or braided hair, serve the purpose of bracelets; but even in this case they show great nicety, being particularly careful to match them as near as possible. They were prodigiously fond of those we gave them, which were only a few beads, secured by thread upon a strip of scarlet cloth, and made to button round the wrist. So much did they at first value them, that a small hatchet and one of these would purchase a hog, which without it could not have been bought for three large hatchets. The women were perpetually teazing the men to dispose of their various articles for these bracelets; at least one of them was always to make a part of the price." W. Long. 156. 0. S. Lat. 19. 28.

OWL, in ornithology. See Trix.

OWLING, so called from its being usually carried on in the night, is the offence of transporting wool or sheep out of this kingdom, to the detriment of its staple manufacture. This was forbidden at common law, and more particularly by statute 11 Edw. III. c. 1. when the importance of our woollen manufacture was first attended to; and there are now many later statutes relating to this offence, the most useful and principal of which are those enacted in the reign of Queen Elizabeth, and since. The statute 8 Eliz. c. 3. makes the transportation of live sheep, or embarking them on board any ship, for the first offence forfeiture of goods, and imprisonment for a year, and that at the end of the year the left hand shall be cut off in some public market, and shall be there nailed up in the openest place; and the second offence is felony. The statutes 12 Car. II. c. 32. and 7 & 8 Will. III. c. 28. make the exportation of wool, sheep, or fuller's earth, liable to pecuniary penalties, and the forfeiture of the interest of the ship and cargo by the owners, if privy; and confiscation of goods, and three years imprisonment to the master and all the mariners. And the statute 4 Geo. I. c. 11. (amended and farther enforced by 12 Geo. II. c. 21. and 19 Geo. II. c. 34.), makes it transportation for seven years, if the penalties be not paid.



OXALIS, woodsorrel: A genus of the pentagynia order, belonging to the decandria class of plants; and in the natural method ranking under the 14th order, *Gruinales*. The calyx is pentaphyllous; the petals connected at the heels; the capsule pentagonal, and opening at the angles. There are seven species; of which the only remarkable is the acetosella, or common woodsorrel. This grows naturally in moist shady woods, and at the sides of hedges in many parts of Britain, and is but seldom admitted into gardens. The roots are composed of many scaly joints, which propagate in great plenty. The leaves arise immediately from the roots upon single long foot-stalks, and are composed of three heart-shaped lobes. They are gratefully acid, and of use in the scurvy and other putrid disorders.

OXFORD, the capital of a county of the same name in England, celebrated for its university, and pleasantly situated in a plain, with a fine fruitful country all around. The composition of the name is obvious. In the British times it seems to have been a place of study. "The wisdom of our ancestors (says Camden) as appears in our history, consecrated even in the British times this city to the muses, translating them from Greeklade (now a small town in Wilts) hither, as to a more fruitful nursery. For Alexander Necham * writes, 'Italy claims superior knowledge of civil law; but the study of divinity and the liberal arts prove, that the university of Paris deserves the preference to all others. Agreeable also to Merlin's prophecy, Wisdom has flourished at the Ford of Oxen, and will in its due time pass over also into Ireland.' But in the following Saxon age, when so many cities were destroyed, it underwent the common fate, and for a long while was famous only for the relicks of Frideswide, who was ranked among the saints for her holy life, merely because she had solemnly devoted herself to God; and Prince Algar, soliciting her in marriage, was miraculously, as they say, deprived of his eyesight."

* De Natura Rerum, lib. 2.

Perhaps the following additional extract from Camden will be more to the purpose in developing the ancient state of learning in this city, than any thing which we could bring forward of our own. "When the storm of the Danish war was over, the most religious prince Alfred* restored their retreats to the long-exiled muses, by founding three colleges, one for grammarians, another for philosophy, and a third for divinity. This will be more fully explained by the following passage in the old annals of the New Monastery at Winchester. 'In the year of our Lord 806, the second year of the arrival of St Grimbald in England, the university of Oxford was begun; the first who presided and read divinity lectures in it being St Neoth, an abbot and able divine, and St Grimbald, a most eminent professor of the incomparable sweetness of the sacred pages; Asser the monk, an excellent scholar, professing grammar and rhetoric; John monk of the church of St David giving lectures in logic, music, and arithmetic; and John the monk, colleague of St Grimbald, a man of great parts, and a universal scholar, teaching geometry and astronomy before the most glo-

* A.D. 886.

Oxford.

glorious and invincible King Alfred, whoſe memory will dwell like honey in the mouths of all." Soon after, as we find in an excellent MS. of the ſaid Aſſer, who was at that time profeſſor here, 'broke out a ſharp and fatal quarrel between Grymbold and thoſe very learned men whom he had brought thither with him, and the old ſcholars whom he found there; who, on his coming, unanimouſly refuſed to receive the rules, methods, and forms of lecturing, that Grymbold introduced. Three years had paſſed without any great difference between them; but the ſecret averſion afterwards broke out with the utmoſt violence. In order to quell it, the invincible King Alfred, as ſoon as he heard of it by the meſſages and complaints from Grymbold, went in perſon to Oxford to put an end to the diſpute, and he took the greateſt pains to hear the cauſes and complaints on both ſides. The foundation of the difference was this: The old ſcholars maintained, that before Grymbold came to Oxford, learning had flouriſhed there, though the ſcholars at that time were fewer than in more ancient times, the greater part being driven out by the cruelty and oppreſſion of the Pagans. They alſo proved and ſhowed, and that by the undoubted teſtimony of ancient chronicles, that the ordinances and regulations of the place were eſtabliſhed by certain religious and learned men, ſuch as Gildas, Melkinus, Ninnius, Kentigern, and others, who had all lived to a good old age in theſe ſtudies, having ſettled matters there in peace and harmony; and alſo that St Germanus came to Oxford, and ſtaid there half a year in his journey over Britain to preach againſt the Pelagian hereſies, and wonderfully approved their plan and inſtitution. The king, with unheard-of condeſcenſion, gave both parties attentive hearing, and repeated his pious and ſeaſonable advice to maintain mutual union and concord, and left them with the proſpect that both parties would follow his advice and embrace his inſtitutions. But Grymbold, offended at this proceeding, immediately retired to the monaſtery at Wincheſter lately founded by King Alfred. He alſo cauſed his tomb to be removed to Wincheſter, in which he had intended to lay his bones when his courſe of life was ended, in the vault under the chancel of St Peter's church at Oxford, which church himſelf had built from the ground of ſtone poliſhed in the moſt coſtly manner.'

"This happy reſtoration of learning was followed in a few years by various calamities. The Danes in the reign of Edward plundered and burnt the place; and ſoon after Harold Harefoot practiſed the moſt inhuman barbarities here in revenge for ſome of his men who were killed in an affray; ſo that the moſt melancholy remove of the ſtudents enſued, and the univerſity remained almoſt extinct, a lamentable ſpectacle till the time of William the Norman. Some have falſely ſuppoſed this prince took the city, miſled by a wrong reading in ſome copies of *Oxonia* for *Exonia*. At that time, however, it was the ſeat of an univerſity, as we learn from theſe words of Ingulphus, who lived at that time. 'I Ingulphus ſettled firſt at Weſtminſter, was afterwards ſent to ſtudy at Oxford, having made greater proficiency than many of my own age in Ariſtotle, &c.' 'What we call an *univerſity*, they in that age called a *ſtudy*." Many are of opinion that it was deſerted till about the year 1129, and that this deſertion was in conſequence of its having been beſieged and taken by William the Conqueror. About this year, however, Robert Pulen began to read lectures in divinity, or (as it is expreſſed in the chronicle of Oſeney abbey) the Holy Scriptures, which had fallen into neglect in England; and ſuch was the reſort of ſtudents to it, that in the reign of King John there were not fewer than 3000. Robert d'Oily, a Norman, to whom William the Conqueror had given the greateſt part of it, built a caſtle on the weſt ſide in 1071; and he is alſo ſuppoſed to have ſurrounded it with walls. In a palace built by Henry I. was born Richard I. commonly called *Cœur de Lion*. About the tenth of King John, there happened a quarrel between the citizens and ſtudents; in conſequence of which many of the latter quitted it, but returned again a few years afterwards. Here Henry III. held a parliament to ſettle the differences betwixt him and his barons; when he confirmed the privileges granted to the univerſity by his predeceſſors, and added others of his own. In this reign the ſtudents are ſaid to have been 30,000, who were all excommunicated by the pope for ſome rudeneſs to his legate. In the time of Duns Scotus, we are told that 30,000 ſcholars attended his lectures. Matthew Paris ſtyles the univerſity of Oxford, 'the ſecond ſchool of the church after Paris, and the very foundation of the church.' The popes had before this honoured it with the title of *Univerſity*, which they had conferred by their decrees on no other but that of Paris, this of Oxford, and thoſe of Bologna and Salamanca. It was decreed in the council of Vienne, that 'ſchools for the ſtudy of the Hebrew, Arabic, and Chaldee languages, ſhould be erected in the ſtudies of Paris, Oxford, Bologna, and Salamanca (as the moſt conſiderable), that the knowledge of theſe languages might prevail by their being thus taught; and that Catholic perſons be choſen, ſufficiently verſed therein, two in each language. For thoſe in Oxford, the biſhops, monaſteries, chapters, convents, colleges, exempt and not exempt; and the rectors of churches throughout England, Scotland, Ireland, and Wales, were to provide a competent maintenance." In Edw. III.'s time, the ſcholars were ſplit into two factions, called the *northern* and *ſouthern men*; a diviſion which was attended with many diſorders and much violence, but in a ſhort time concord and harmony again prevailed.

As colleges began about this time to be founded and endowed, we ſhall here preſent our readers with a liſt of them, together with the time when, and the perſons by whom, they were founded.

| *Colleges.* | *Founders.* | *Kings reigns.* |
|---|---|---|
| Univerſity. | King Alfred. | Alfred. |
| Baliol. | Sir John Baliol, father to the king of Scots | Henry III. |
| Merton. | Walter Merton, lord chancellor and biſhop of Rocheſter. | Edward I. |
| Oriel. | Edward II. | Edw II. |
| Exeter | Walter Stapleton, biſhop | Edw. II. |
| Queens. | Robert Eglesfield, B D. | Edw III. |
| New College. | William of Wickham, biſhop of Wincheſter, lord chancellor. | Edw III. |
| Lincoln. | Richard Fleming, biſhop of Lincoln. | Henry VI. |
| All-Souls. | Hugh Chicheley, archbiſhop of Canterbury. | Henry VI. |
| Magdalen. | William Wainfleet, biſhop of Wincheſter, lord chancellor. | Henry VI. |
| Brazen-Noſe. | William Smith, biſhop of Lincoln, and Richard Sutton, Eſq; | Hen VIII. |

Corpus-

Oxford.

| *Colleges.* | *Founders.* | *Kings reigns* |
|---|---|---|
| Corpus-Christi | Richard Fox, bishop of Winchester, and lord privy seal. | Hen. VIII. |
| Christ-Church. | Henry VIII and Cardinal Wolsey | Hen VIII. |
| Trinity | Sir Thomas Pope. | Mary |
| St John Baptist. | Sir Thomas White, merchant of London | Mary. |
| Jesus | Queen Elizabeth | Elizabeth. |
| Wadham. | Nicolas and Dorothy Wadham. | James I |
| Pembroke. | Thomas Tisdale, Esq; and Dr Richard Whitwick. | James I. |

Worcester was called *Gloucester-hall* till lately, that it was endowed by Sir Thomas Coke, and made collegiate.

Hartford was *Hart hall* till 1740, that it was erected into a college by Dr Richard Newton

All these are richly endowed, and have fine gardens, libraries, chapels, &c. The halls in which the students maintain themselves, except a few that have exhibitions, are these: St Edmund's, belonging to Queen's college; Magdalen, to Magdalen college; St Alban's, to Merton; St Mary's, to Oriel; New-Inn, to New-college. Several persons have been great benefactors to particular colleges, as Dr Ratcliffe to University college; Colonel Codrington and Dr Clarke, to All-Souls; Queen Caroline, to Queen's; the beforementioned Dr Clarke and Mrs Eaton, to Worcester; Dr Wake, archbishop of Canterbury, to Christ-church. The most considerable of these colleges are Magdalen's and Christ-church, which are as noble foundations as any in the world. The church of the latter is the cathedral, and has a dean, eight canons, eight chaplains, eight singing men, eight choristers, a teacher of music, and an organist. Each of the colleges has its visitor appointed by its statutes, except Christ-church, which is subject to the visitation of the Sovereign alone. The other remarkable buildings belonging to the university are, first, the public schools; secondly, the Bodleian or public library; thirdly, Ratcliffe's library, a most elegant structure, for building and furnishing which, Dr Ratcliffe left 40,000l; fourthly, the theatre, built by Sheldon, archbishop of Canterbury; fifthly, the museum, in which is an elaboratory and a repository for natural and artificial rarities and antiquities; sixthly, the Clarendon printing-house, so called, because it was built partly with the money arising to the university by the sale of Lord Clarendon's history. To the south of Magdalen college lies the physic garden, instituted by the Earl of Danby, and much improved by Dr Sherrard. It contains five acres, in which is a complete series of such plants as grow naturally, disposed in their respective classes; together with two neat and convenient green-houses, stocked with a valuable collection of exotics, and a hot-house, where various plants brought from the warmer climates are raised. The whole body of the univesity, including professors, fellows, and students of all sorts, exceeds 3000. Each college has its particular statutes and rules for government. There are four terms in the year for public exercises, &c. and particular days and hours for public lectures by the several professors. The university is governed by a chancellor, high-steward, vice chancellor, two proctors, a public orator (see *Public* Orator); a keeper of the archives, a register, three esquire beadles, and three yeomen-beadles. As to the city, it has had the same privileges granted to it as London, particularly an exemption from toll all over England. It was made an episcopal see in 1541, when Robert King, the last abbot of Oseney, was elected Bishop. It is governed by a mayor, high-steward, recorder, four aldermen, eight assistants, two bailiffs, a town-clerk, two chamberlains, all that have borne the office of bailiff and chamberlain, and twenty-four common-council men; but these are subject to the chancellor or vice-chancellor of the university in all affairs of moment; and not only the mayor, but the principal citizens, and sheriff of the county, take an oath to maintain the privileges of the university. The city, including the colleges, is a place of considerable magnitude, having 13 parish-churches, besides the cathedral, well built, clean, and regular. At the entrance of the town from the Woodstock and Banbury roads, a neat hospital hath been lately erected by the trustees of Dr Ratcliffe's benefaction, out of the surplus money remaining after defraying the expence of his library. The male line of the family of Vere, to whom the city had given the title of earl for 500 years, failing in Aubrey de Vere, who was twentieth earl, Queen Anne conferred the title upon Robert Harley, a descendant of the Veres, in whose family it still continues. The chief trade of the city is in malt, conveyed in barges to London. It is impossible, in the narrow bounds necessarily prescribed to this article, to give so particular an account of this celebrated place as its importance demands: but we shall refer our readers to the article University, when this seminary, amongst others, shall be more particularly described.

Oxfordshire || Oxuclæ.

OXFORDSHIRE, which made part of the territory of the ancient *Dobuni*, a county of England, bounded on the west by Gloucestershire; on the south, where it is broadest, the river Isis divides it from Berkshire; on the east, it is bounded by Buckinghamshire; and on the north, where it terminates in a narrow point, it has on the one side Northamptonshire, and on the other Warwickshire. It extends 50 miles from north to south, and 35 from east to west, making about 130 in circumference: within which are contained one city, 15 market towns, 280 parishes, 14 hundreds, 534,000 acres, and about 120,000 souls. The air is sweet and pleasant, and the soil rich and fertile. The lower parts consist of meadows and corn-fields, and the higher were covered with woods till the civil wars; in which they were so entirely destroyed, that wood is now extremely scarce and dear, except in what is called the chiltern, and so is coal; of consequence fuel bears an exorbitant price. The county is extremely well watered; for besides the Isis, Tame, Cherwell, Evenlode, and Windrush, there is a great number of lesser rivers and brooks. One of the four great Roman ways passes quite thro' this county, entering at the parish of Chinner, and going out at that of Goring. There is another lesser one, that extends between Colnbrook and Wallinford, called *Gremesdike*. The county sends nine members to parliament, viz. two for the shire, two for the city, two for the university, two for new Woodstock, and one for Banbury.

OXGANG, or Oxgate, is generally taken, in our old law-books, for 15 acres, or as much ground as a single ox can plough in a year.

OXUCLÆ, in natural history, the name of a genus of fossils of the class of selenitæ, but of the columnar, not the rhomboidal, kind. Of this genus there are only

only two known species: 1. A fine kind with thin flakes and transverse filaments, found in the clayey banks of the river Nen, near Peterborough in Northamptonshire; and, 2. A dull kind with thick plates and longitudinal filaments. This is not uncommon in Yorkshire, and lies sometimes in a yellow and sometimes in a blue clay.

OXUS, or Jihun, a large river of Asia, much taken notice of in ancient histories, but does not rise in the north of India, as most writers affirm; for, according to the best and latest maps made by those who have been upon the spot, it ran a course of about 260 miles from the Caspian sea to the lake Aral, whose dimensions have lately been discovered, and is but very lately known to the Europeans; but, as it passes through a desart country abounding with sands, the inhabitants so diverted its course, that the old channel can hardly be discovered.

OXYCRATE, in pharmacy, a mixture of vinegar and water, proper to assuage, cool, and refresh. The usual proportion is one spoonful of vinegar to five or six spoonfuls of water.

OXYD, is the term used in the new chemical nomenclature to express a very numerous class of bodies formed by the union of certain bases with a smaller proportion of oxygene than what is necessary for their conversion into acids. (See Oxygene). The most remarkable of these bodies are what were formerly called metallic calces, and have for their base some metallic substance. It is in this state that metals are contained in their ores, from which they are extracted, and converted into the reguline or metallic form, by the process called *reduction*. Metals are converted into oxyds by combustion, and by solution in acids; and many of them assume this form from the action of the atmosphere alone, but more readily when this is assisted by moisture. During their conversion into oxyds, metals lose their splendor, and, acquiring a considerable increase of absolute weight, put on an earthy, pulverulent appearance. It has of late been supposed that all earths are metallic oxyds, and that all of them would be capable of reduction, were we possessed of any body for which oxygene had a stronger elective attraction than that by which it is kept in conjunction with the bases of these supposed oxyds. But this opinion, being perfectly unsupported by experiment, cannot be admitted in a science which, like the chemistry of the present day, aspires to demonstration.

The term oxyd, however, is not confined to the combinations of metals with oxygene, but expresses that first degree of oxygenation in all bodies which, without converting them into acids, causes them to approach to the nature of salts; and of these there is a prodigious variety; as the oxyd of phosphorus, which is the white concrete substance into which that body is converted by combustion; the oxyd of azote, or nitrous air of Dr Priestley; and a great many others. Most of the oxyds from the vegetable and animal kingdoms have bases compounded of different simple combustible bodies. Thus sugar, all the gums, mucus, and starch, are vegetable oxyds; the bases of which are hydrogene and carbonne, combined in various proportions. We find accordingly, that all these bodies are, by farther additions of oxygene, convertible into acids; and it is probable that these acids differ from each other only in the proportion of the hydrogene and carbonne in their bases. The bases of the animal oxyds are still more complicated; all, or most of them, consisting of various combinations of azote, phosphorus, hydrogene, carbonne, and sulphur. See Calx, Chemistry, and Table of Chemical nomenclature.

OXYDATION, is a term employed by the later chemists to express the process by which bodies are converted into oxyds; and it is allowed on all hands to be exactly similar to combustion. The nature of this process has been much disputed; and the question on this subject involves in itself great part of the controversy between the followers of the immortal Stahl and the justly celebrated Lavoisier, the founders of the phlogistic and antiphlogistic theories, which have for some years divided the chemical world. A view of this question, sufficiently distinct, may be taken from the case of metals and their oxyds. Metallic calces (*oxyds* say the phlogistians) are simple bodies, which, when united with phlogiston, form metals. The process of *reduction* consists in exposing the ores of metals to an intense heat in contact with some inflammable body, most commonly charcoal. During this operation, say they, the charcoal being inflamed, parts with its phlogiston, which is immediately absorbed by the calx, and a metal is formed. Lavoisier, and his followers, on the contrary, contend that metals are simple bodies; but that in the state of oxyds, that is, as they commonly exist in their ores, they are combined with oxygene, but as oxygene at a high temperature is more strongly attracted by charcoal than by most metals, during the process of reduction the oxyd is decompounded, and the oxygene unites with the charcoal to form carbonic acid, leaving the regulus or metal free. On this point hinges the great question, the decision of which must materially affect almost every part of chemical theory. Without presuming to decide between these two opinions, the former of which is still supported by one or two chemists of the first rank, we agree with Dr Black in thinking that, though there still remain a few facts which have not been thoroughly explained on antiphlogistic principles, this theory is much more simple, and better supported by facts, than any that preceded it. It has this great advantage over the doctrine of Stahl, that it requires not the supposition of an arbitrary body, which does not affect our senses, and of the existence of which we have not even a shadow of proof. Perhaps we may farther venture to assert, that though it may be extremely difficult, or even impossible, to refute the phlogistic theory, influenced as we have all been by a strong prejudice in its favour; yet, had it been brought forward for the first time, when our knowledge had arrived at the point which it now holds, it never would have been generally received. See Calcination, Chemistry, Combustion, Inflammation.

OXYGENE, a term adopted in the new chemical nomenclature, to express the acidifying principle; from ὀξὺς "acid," and γεννάω "to generate." It is not found naturally in a separate state, but always combined or mixed with some other substance. In its aeriform or elastic state, it is called by the French chemists *oxygenous gas*, and is the same as the *dephlogisticated air* of Priestley

Oxygene || Oyster

Priestley and Cavendish, the *empyreal air* of Scheele, the *vital air* and *pure air* of other modern chemists. It was called *dephlogisticated* by the followers of Stahl's doctrine, who imagined it to be air deprived of phlogiston; the epithet of *empyreal* was given to it by Mr Scheele, who first discovered it to be the only constituent part of the atmosphere which contributes to support inflammation or combustion. He made many curious experiments on inflammation, and was the first who completely analised common air, showing it to consist of 27 parts of empyreal, 72 of foul, and 1 of fixed air. He found, that these 27 parts only were consumed by a burning body; and that these, during the act of combustion, were united and combined with the inflammable body burnt in them, so as to form a compound no longer combustible. Lavoisier extending these experiments, found that the body, thus produced by empyreal air, being combined with the matter of the inflammable body burnt in it, was, in many cases, an acid; in consequence of which property he gave this air the name of *oxgene*, i. e. "the generator of acidity." He was perhaps [illegible] in adopting this name; for the same air [illegible] combination with inflammable matter, form[illegible] pounds that are by no means acid, of which we [illegible] tent ourselves with producing only one example, namely *water*, which is the compound resulting from the combination of this air with inflammable air. See WATER.

Common atmospheric air was found by Scheele to promote animal life in a manner somewhat similar to its promoting combustion. He extended his experiments to this subject also; and he concludes, that this empyreal air is the only part of the atmosphere which is capable of supporting animal life, and that no animal can exist a minute without it. In consequence of this property it has been called *vital air*. Since, however, it is absolutely necessary for the support both of combustion and of animal life, and since neither of these can exist without it, both the terms *empyreal* and *vital* are deficient, expressing only certain properties of this elastic fluid (which may be also said of the word *oxygene*); and hence some later chemists have suggested the propriety of designing it by the name of *pure air*. See COMBUSTION, INFLAMMATION, CHEMISTRY, AIR, WATER.

OXYGLYCU, a species of drink prepared of the sweetest honey-combs macerated and boiled. The combs, from which all the honey has been expressed, are put into a pot with pure water, and boiled till they seem to have deposited all their contained honey in the water. This liquor is to be kept; and, when diluted with cold water, is to be drank in the summer-time, in order to remove thirst.

OXYMEL, in pharmacy, a composition of vinegar and honey. See PHARMACY.

OYER, in law-books, seems to have been anciently used for what is now called *assises*. See ASSISE.

OYES, a corruption of the French OYEZ, *Hear ye*; a term or formula frequently used by the criers in our courts on making proclamations, or to enjoin silence.

OYSTER, in zoology. See OSTREA.

*OYSTER-Catcher*. See HÆMATOPUS.

*OYSTER-Fishery*. See *Oyster*-FISHERY and OSTREA.

*OYSTERS, Fossils*. The largest bed that is known of fossile oysters is that near Riding in Berkshire. They are entirely shaped, and have the same substance with the recent oyster-shells; and yet since the oldest histories that mention the place give an account of them, we must suppose they have lain there for a long time. They extend over no less than six acres of ground; and just above them is a large stratum of a greenish loam, which some writers call a green earth, and others a green sand. It is composed of a crumbly marle, and a large portion of sand. Under them is a thick stratum of chalk. They all lie in a level bed; and the strata above the shells are natural, and appear never to have been dug through till the time of finding the shells.

*Phil. Trans.* n° 261. p. 484.

The oyster-shells and green earth united make a stratum of about two feet thick; and over this there is a much thicker stratum of a bluish and very brittle clay; but neither has this ever been dug through, except where the shells are found. This is vulgarly denominated *piercy-clay*, and is esteemed useless. This clay-bed is about a yard deep, and above it is a stratum of fuller's earth [illegible] about two feet and a half deep; it is extremely [illegible] is used by the clothiers. Over this there [illegible] of a fine white sand, unmixed either [illegible] clay or fuller's earth: this is near [illegible] and above it is a stratum of a stiff [illegible] tiles are made. This is again cove[illegible] vegetable mould; the depth however o[illegible] of the clay cannot be ascertained, on [illegible] the unevenness of the hill. These oysters are [illegible] found whole, but most frequently in single [illegible]. When [illegible] are in pairs, there is generally some of the green [illegible] found within them: they seldom stick very [illegible] together; so that unless very carefully taken up, it is not easy to preserve them in pairs.

*OYSTER-Shells*, an alkali far more generally allowed, and are in all better medicines than many of the more costly and pompous alkalis of the same class. The proof of alkalis is in their solution by acid spirits; and Mr Homberg found, that they dissolved far easier in acids of nitre and sea-salt, than either pearls or coral, or indeed than any of the rest. This he supposes to be owing to their containing in the body of the shell a large portion of sal-salsus, which is easily perceived upon the tongue, and which keeps the whole substance of the shell in a sort of half dissolved state. These shells are found to produce very sensible effects on the stomach, when it is injured by acid humours; and Mr Homberg thinks, that this easiness of solution is a great argument for their good effects, and that the quantity of sal-salsus which it contains, contributes not a little towards it; for we are not to look upon that as a salt merely, but as a salt of a peculiar nature, formed of sea-salt by the organs of the animal, and the several fermentations it undergoes in the body of it, in the same manner as the nitrous and other salts of the earth cease to be nitrous, &c. whenever they become blended with the juices of plants, and form with them a salt peculiar to that plant; which is evidently the case as far as respects this salt, it being plainly of a more penetrating taste, and of a different smell, from the salt left by the sea-water between the several external scales or flakes of the shell.

*Mem. Acad. Par.* 1700.

shell. Oyster-shells being thus found by Mr Homberg to be a very valuable medicine, and as one of the common methods of preparing them is by calcination, which, he observes, considerably impairs their virtues, he gives the following method of preparing them for taking inwardly, which he himself always used. Take the hollow shells of the oysters, throwing away the flat ones, as not sufficiently good; make them perfectly clean, and then dry them in the sun; when they appear dry, beat them to pieces in a marble mortar: they will still be found to contain a large quantity of moisture; lay them therefore again in the sun till perfectly dried, and then finish the powdering them, and sift the powder through a fine sieve. Give 20 or 30 grains of this powder every morning, and continue it three weeks or a month. See CHEMISTRY, n° 1087.

OZÆNA, a foul and malignant ulcer of the nose, distinguished by its fœtor, and often accompanied with a caries of the bones of the nose.

OZANAM (James), an eminent French mathematician, born at Bolignen[illegible] in Bresse, in 1640, of a wealthy family. His father [illegible] him a good education, and designed him for [illegible], but some mathematical books falling into [illegible] hands, inspired him with a love for that science [illegible] had no master to instruct him, he [illegible] in it, that, at 15 years of age, he [illegible] mathematics, which he thought [illegible] works he afterwards published. He [illegible] taught that science at Lyons; and his [illegible] brought him in a considerable revenue, till the year 1701: at which period, the war breaking out on the succession to the crown of Spain, he lost almost all his scholars, and was reduced to a very melancholy situation; and his wife dying the same year, he was so afflicted, that he never perfectly recovered it. In 1702 he was admitted into the Royal Academy of Sciences; and died of an apoplexy in 1717.—He was of a mild and serene temper, of singular generosity, and of a cheerful disposition.—He would not allow himself to know more of religion than the common people. He used to say, that "it was the business of the doctors of the Sorbonne to dispute, of the pope to decide, and of a mathematician to go to heaven in a perpendicular line." His works are very numerous, and have met with the approbation of the learned. The principal are, 1. Practical geometry, 12mo. 2. A mathematical dictionary. 3. A course of mathematics, 5 vols, 8vo. 4. Mathematical and philosophical recreations, the most complete edition of which is that of 1724, in 4 vols, 8vo. 5. An easy method of surveying. 6. New elements of algebra, a work much commended by Monf. Leibnitz. 7. Theoretical and practical perspective, &c.

OZELL (John), a well-known translator, educated in Christ's Hospital, was possessed of a competent fortune, and always enjoyed good places, being auditor-general of the city and bridge accounts, of St Paul's cathedral and of St Thomas's hospital. Notwithstanding his attention to business, he still retained a love for polite literature: and though he did not appear as an original author, yet having made himself master of most of the living languages, he favoured the world with many translations from these, as well as from the Latin and Greek; which, if they are not the most elegant, are generally faithful and true to the originals. He died in the year 1743.

OZIAS, in sacred history, the son of Micha, of the tribe of Simeon, one of the governors of Bethulia when it was besieged by Holofernes. He vigorously supported the siege against this general, and received Achior into his house, when he had been driven from the Assyrian camp. Finding however at length that the city was reduced to great necessity for water, and that the people mutinied against him, he promised to surrender the place in five days, if in that time God did not send them relief. Judith (vi. vii. viii. ix. and x.) being informed of this resolution, [illegible] speak with Ozias and the other leading men [illegible] made a prudent remonstrance upon their [illegible] prescribe a time to the Lord, in which he [illegible] them; encouraged them to patience; [illegible] without discovering her design, told them that she would go out in the night. Ozias being at the gate of the city when Judith departed, opened it to her, and waited in the city for the success of her undertaking, praying with her people to God that he would be pleased to deliver them. See the article JUDITH.

OZLEWORTH, in England, in Gloucestershire, about 18 miles from Gloucester. It is remarkable for nothing but that in one year, during the reign of Queen Elizabeth, there were no less than 231 foxes killed at it.

OZOLÆ, or OZOLI, a people who inhabited the eastern parts of Ætolia which were called *Ozolea*. This tract of territory lay at the north of the bay of Corinth, and extended about 12 miles. They received their name from the bad stench (ὀζη) of their bodies and clothes, which were the raw hides of wild beasts. Some derive it from the stench of the stagnated water in the neighbouring lakes and marshes. According to a fabulous tradition, they received their name from a very different circumstance: During the reign of a son of Deucalion, a bitch brought into the world a stick instead of whelps. The stick was planted into the ground by the king, and it grew up to a large vine, and produced grapes, from which the inhabitants of the country were called *Ozolæ*, not from ὀζειν, "to smell bad," but from ὀζος, "a branch or sprout." The name *Ozolæ*, on account of its indelicate signification, was highly disagreeable to the inhabitants; they therefore exchanged it soon for that of Ætolians.

# P.



P, the 15th letter and 11th consonant of the alphabet; the sound of which is formed by expressing the breath somewhat more suddenly than in forming the sound of *b*; in other respects these two sounds are pretty much alike, and are often confounded one with another. When *p* stands before *t* or *s*, its sound is lost; as in the words *psalms*, *psychology*, *ptolemaic*, *ptisan*, &c. When placed before *h*, they both together have the sound *f*; as in *philosophy*, *physic*, &c.

*P* and *B* are so like each other, that Quintilian declares, that in the word *obtinuit*, his reason required him to put a *b*, but that his ears could hear nothing but a *p*, *optinuit*: hence in ancient inscriptions, and old glossaries, it appears that these two letters have often been confounded. Several nations still pronounce one for the other, the Welch and Germans particularly, who say, *ponum vinum*, for *bonum vinum*. Plutarch observes, it was usual for those of Delphi to say βαλειν for παλειν, βικρον for πικρον, and among the Latins, as often as an *s* followed, the *b* was changed into a *p*, as *scribo*, *scripsi*.

As an abbreviation, P stands for *Publius*, *Pondo*, &c. P. A. DIG. for *Patricia Dignitas*; P. C. for *Patres Conscripti*; P. F. for *Publii Filius*; P. P. for *Propositum*, or *Propositum publice*; P. R. for *Populus Romanus*; P. R. S. for *Pretoris sententia*, P. R. S. P. for *Preses provinciæ*.

P. M. among astronomers, is frequently used for *post meridiem*, or "afternoon;" and sometimes for *post mane*, "after the morning, i. e. after midnight." P was also used among the ancients as a numeral letter, signifying the same with the G, viz. a hundred; according to the verse of Ugutio,

*P similem cum G numerum monstratur habere.*

Though Baronius thinks it rather stood for seven.

When a dash was added a-top of $\overline{P}$, it stood for four hundred thousand.

St Jerome observes on Daniel, that the Hebrews had no *P*; but that the *ph* served them instead thereof; adding that there is but one word in the whole Bible read with a *P*, viz. *apadno*. The Greek π signified 80. On the French coins, *P* denotes those that were struck at Dijon.

In the Italian music, P stands for *piano*, or "softly:" and P. P. P. for *pianissimo*, or "very softly."

Among physicians, P stands for *pugil*, or the eighth part of an handful; P. Æ. *partes equales*, or equal parts of the ingredients; P. P. signifies *pulvis patrum*, or Jesuit's bark in powder; and *ppt. preparatus* or prepared.

PABULUM, among natural philosophers, the same with FUEL.

PACA, see MUS, p. 465.

PACE, a measure taken from the space between the two feet of a man in walking; usually reckoned two feet and a half, and in some men a yard or three feet. The geometrical pace is five feet; and 60,000 such paces make one degree on the equator.

PACE, in the manege, is of three kinds, viz. walk, trot, and gallop; to which may be added an amble, because some horses have it naturally.

Horses which go shuffling, or with mixed paces between the walk and amble, are for the most part of no value; which commonly proceeds from their fiery temper, but sometimes from a weakness in their reins or legs.

PACE (Richard), a learned Englishman, born about the year 1482. He was educated at the charge of Thomas Langton, bishop of Winchester, whom he served as an amanuensis, and afterwards entered into the service of cardinal Bainbridge. His accomplishments rendered him so acceptable to Henry VIII. that he made him secretary of state; and, entering into orders, he was admitted prebendary in the church of York, archdeacon of Dorset, and dean of St Paul's, &c. which preferments were conferred on him during his absence on foreign embassies. In 1524 he was sent to Rome on the death of Pope Leo X. to solicit the papal chair for cardinal Wolsey; but a new pope was elected before his arrival, a circumstance that proved the epocha of his troubles. He fell under the displeasure of the disappointed cardinal; and being soon after employed as ambassador at Venice, he was so neglected and hardly used, that he was seized with a frenzy: upon which the king ordered him home; and being carefully attended by the physicians at the king's command, he was in a short time restored to the use of his reason, and then applied himself to the study of the Hebrew tongue. Being now introduced to his Majesty, he remonstrated against the cardinal's cruelty: who being ordered to clear himself, summoned Pace before him, sitting in judgment with the duke of Norfolk and others; who condemned Pace, and sent him to the Tower; where he remained two years, till he was discharged by the king's command.—When he was enlarged, he resigned his deaneries, and died in retirement at Stepney in 1532; after having wrote several works. There is an elegant and just character of him by Leland, written upon his return from Venice. He was much esteemed by the learned men of his time, especially Sir Thomas More and Erasmus. The latter had a great opinion of Pace on account of his candour and sweetness of temper; so that he was much afflicted at his misfortunes, and could never forgive the man that caused them. Stow gives him the character of a right worthy man, and one that gave in council faithful advice: learned he was also, says that antiquary, and endowed with many excellent parts and gifts of nature; courteous, pleasant, and delighting in music; highly in the king's favour, and

and well heard in matters of weight. There is extant a remarkable letter of his to the king, written in 1527, wherein he very honestly gives his opinion concerning the divorce: and Fiddes observes, that he always used a faithful liberty to the cardinal, which brought him at last to confinement and distraction.

PACHAMAC, a valley of Peru, in South America, ten miles south of Lima; celebrated for its pleasantness and fertility, but more on account of a magnificent temple built by the Incas of Peru, to the honour of their god. When the Spaniards conquered Peru, they found immense riches therein.

PACHODECARHOMBIS, in natural history, the name of a genus of fossils, of the class of *selenitæ*. The word is derived from the Greek παχυς *thick*, δεκα *ten*, and ρομβος *a rhombus*, and expresses a thick rhomboidal body composed of ten planes. The characters of this genus are, that the selenitæ of it consist of ten planes; but as the top and bottom in the leptodecarhombes, or most common kind of the selenitæ, are broader and larger planes than any of the rest, the great thickness of this genus, on the contrary, makes it four longer planes in all the bodies of it, meeting in an obtuse angle from its sides, its largest planes. There are four species of it.

PACHSU, a small island in the Mediterranean sea; near the coast of Epirus, and in European Turkey. It lies south of Corfu, and is subject to Venice.

PACIFIC OCEAN, that vast ocean which separates Asia from America. It is called *Pacific*, from the moderate weather the first mariners who sailed in it met with between the tropics: and it was called *South Sea*, because the Spaniards crossed the isthmus of Darien from north to south when they first discovered it; though it is properly the Western ocean with regard to America.

Geographers call the South Sea *Mare Pacificum*, "the Pacific Ocean," as being less infested with storms than the Atlantic; but M. Frezier affirms it does not deserve that appellation, and that he has seen as violent storms therein as in any other sea; but Magellan happening to have a very favourable wind, and not meeting with any thing to ruffle him when he first traversed this vast ocean in 1520, gave it the name which it has retained ever since. Maty, however, adds, that the wind is so regular there, that the vessels would frequently go from Acapulco to the Philippine Islands without shifting a sail.

PACK, in commerce, denotes a quantity of goods made up in loads or bales for carriage. A pack of wool is 17 stone and 2 pounds, or a horse's load.

PACKAGE, is a small duty of one penny in the pound, paid for all goods not particularly rated.

PACKET, or PACKET BOAT, a vessel appointed by the government to carry the mail of letters, packets, and expresses from one kingdom to another by sea in the most expeditious manner. Thus, the packet-boats, under the direction of the post-master-general of Great Britain, carry the mails from Dover to Calais, from Falmouth to Lisbon, from Harwich to Helvoetsluys, and from Parkgate to Dublin. See POST.

PACOS, in zoology, a name given to a species of camel, commonly, though improperly, reckoned a species of sheep; and known among many by the name of the *Indian sheep*, or *Peruvian sheep*. See CAMELUS, p 60.

This creature has been accounted a sheep, because its hair is so long as to resemble wool, and it is prodigiously thick, its head and neck alone having more wool on them than the whole body of our largest sheep. Its body is clothed in the same proportion with a woolly hair equally fine.

PACTOLUS (anc. geog.), a river of Lydia, called *Chrysorrhoas*, from its rolling down golden sand, according to Herodotus, Plutarch, Pliny, and Strabo; rising in mount Tmolus (Strabo). From this river Crœsus is thought to have had all his riches. In Strabo's time it ceased to roll down any. It ran through Sardes; after which it fell into the Hermus, and both together into the Ægean sea at Phocæa in Iona. A river celebrated by Virgil, Ovid, Lucon, Lycophron, Horace, Appollonius.

PACUVIUS (Marcus), of Brundusium in Calabria, a tragic poet in high reputation about the year of Rome 600. He was nephew of Ennius; published several theatrical pieces, though we have only some fragments of his poetry remaining; and died at Tarentum at above 90 years of age.

PADAN-ARAM (Bible), literally *the plains of Aram*, or *Syria*; translated by the Seventy simply *Mesopotamia*, or *Mesopotamia of Syria*; by the Vulgate, *Syria*; the Syrians on this and on the other side of the Euphrates, not differing remarkably from each other in language and manners, as Josephus allows.

PADDOC, or *PADDOC-Course*, a piece of ground encompassed with pales or a wall, and taken out of a park, for exhibiting races with greyhounds, for plates, wagers, or the like.

A paddoc is generally a mile long, and a quarter of a mile broad: at the one end is a little house where the dogs are to be entered, and whence they are slipped; near which are pens to inclose two or three deer for the sport. Along the course are several posts, viz. the low post, which is 160 yards from the dog-house and pens; the quarter of a mile post, half-mile post, and pinching post; besides the ditch, which is a place made to receive the deer, and preserve them from farther pursuit. And near this place are seats for the judges chosen to decide the wager.

The keepers, in order to slip the dogs fairly, put a falling collar upon each, slipped round a ring; and the deer being turned loose, and put forward by a teazer, as soon as he is arrived at the low post, the dog-house door is thrown open, and the dogs slipped. If now the deer swerve so much, as that his head is judged nearer the dog-house than the ditch before he arrive at the pinching-post, it is no match, and must be run over again three days after: but if the deer runs straight beyond the pinching post, then that dog which is nearest when he swerves, or is blanched by any accident, wins the match; but if no such swerve happens, then the match is won by the dog who first leaps the ditch.

PADERBORN, a duchy of Germany in the circle of Westphalia, has the county of Lippe on the north and west; Hesse-Cassel and Waldeck, on the south;

Paderborn. and Munster, with the duchy of Westphalia, on the west. Its greatest length from east to west is about 40 miles, and its breadth where widest 30. Some parts of it yield good pasture, and breed abundance of cattle; but it is not very fruitful in corn. There is a heath called the *Senne* or *Sende*, of great extent, but very barren and desolate. There are, however, good iron mines in the country, with salt and medicinal springs, plenty of deer and other game; and it is watered with several rivers abounding with fish, as the Weser, the Dimer, the Biver, the Nette, the great Emmer, the Lippe, the Alme, and the Pader. It contains 54 parishes, in which are 25 market towns and 16 monasteries. The Roman Catholic is the predominant religion of the country, yet there are also many Protestants in it. The bishopric was erected by Charlemagne, towards the close of the eighth century, and the cathedral was consecrated by pope Leo in person, anno 796. The bishop is sovereign of the country, a prince of the empire, and suffragan of the archbishop of Mentz. His revenue is about 30,000 pounds a year, and he is able to raise 3000 men. In the matricula his assessment is 18 horse and 3[illegible] or 352 florins monthly in lieu of them. Towards [illegible] charges of the sovereign courts of the empire, [illegible] for each term 162 rix-dollars and 29 kruitzers. [illegible] chapter consists of 24 capitular canons, who must prove their noble extraction by four descents. The arms of the bishopric are a cross or, in a field gules. For the government of it, and the administration of justice, there are several councils and colleges under the bishop. Here are also a hereditary marshal, sewer, cup-bearer, chamberlain, steward, and purveyor. It was in this bishopric that Quintilius Varus, with the Roman army under his command, was routed by the Germans under Arminius.

Paderborn, the capital of the above bishopric. It stands 40 miles north-west of Cassel, 50 south-east of Munster, and 60 south-west of Hanover; being a large, populous, well-built, and well fortified city. Its name is compounded of *pader*, a rivulet, which rises just under the high altar of the cathedral, and *born*, *i. e.* a spring. It was one of the Hanse-towns; and, till 1604, an imperial city. The cathedral is a grand fabric, inferior to few in the empire. There is a gold crucifix in it of 60 pounds weight, presented by Otho II. The university, of which the Jesuits have the direction, was founded in 1592, and the walls were built in the beginning of the 11th century. In 1530 an attempt was made to introduce Lutheranism; but 16 of the principal citizens who had embraced it were executed, and the rest obliged to abjure it. Duke Christian of Brunswick carried off from hence, in 1692, the silver images of the twelve apostles, and the silver coffin of St. Lotharius; and had them coined into money, with this inscription, *God's Friend, the Priest's Enemy.* The trade of this town, though formerly great, is now inconsiderable; and the inhabitants subsist mostly by agriculture and breeding of cattle. Though the bishop has a palace in the city, he resides (when he vouchsafes to visit this country, which is seldom, having other and more valuable benifices) at Neuhaus, seven miles off, where he has a magnificent castle. Charlemagne and other emperors sometimes resided here, and held diets of the empire.

Padogi ‖ Padus.

PADOGI, a punishment used in Russia. The body of the criminal is stripped to the waist, and then laid upon the ground; one slave holds the head of the person to be punished between his knees, and another the lower part of the body; then rods are applied to the back till some person gives notice to desist, by crying out, enough. This punishment is considered in Russia merely as a correction of the police, exercised on the soldier by military discipline, by the nobility on their servants, and by persons in authority over all such as are under their command. After the accession of Elizabeth to the throne of Russia, the punishments were reduced to two kinds, viz. the padogi and Knout.

PADUA, an ancient, large, and celebrated city of Italy, with a university and a bishop's see. It is also capital of the Paduano; but is much less considerable than it was formerly; for it now contains no more than 3[illegible],000 inhabitants, whereas it formerly had 10[illegible],000, and many of the houses are gone to ruin: however, the hall where justice is administered is a superb structure. The [illegible] and the college of the university, [illegible] led the *Old Town*; and there are p[illegible] houses, where persons may walk [illegible]d to the weather. The garden of [illegible] curious, on account of the number of plants. Here a student may take his degrees, let him be of what sect of Christianity he will; nay, though he should be a Jew or a Turk. The patron of this city is St Anthony, who lies in the cathedral; they have such a veneration for him, that the beggars do not ask charity in the name of God, but for the love of St Anthony. The Jews live in a distinct part of the city; and the neighbouring mountains produce excellent wine and oil, with delicious fruit. It was taken by the Venetians in 1706. It is seated on the rivers Brentac and Bachiglione, in a fine plane, and is about seven miles in circumference. E. Long. 11. 55. N. Lat. 45. 24.

PADUAN, among the medalists, a modern medal struck in imitation of the antique, or a new medal struck with all the marks and characters of antiquity. This name is properly applicable to those medals only that were struck in the seventh century by an Italian painter born at Padua; who succeeded so well in the imposture, that the best judges are at a loss to distinguish his medals from the genuine ones. Though it is frequently used in general for all medals of this kind.

PADUANO, a small province of Italy, in the territory of Venice, bounded on the east by the Dogado, on the south by the Polesino di Rovigo, on the west by the Veronese, and on the north by the Vicentino. Its soil is well watered; and is one of the most fertile in Italy. The province is about 40 miles in length, and 35 in breadth. Padua is the capital town.

PADUS, anciently called *Eridanus*, especially by the Greeks; a river famous for the fable of Phaeton, (Ovid). It rises in mount Vesulus, in the Alpes Cothiae, from three springs, dividing the Cisalpine Gaul into the Transpadana and Cispadana, (Strabo); and swelled by other rivers falling into it on each side from the

Padus ‖ Pagan.

the Alps and Apennines, it discharges itself with a course from west to east, at seven mouths, into the Adriatic (Mela). The lake through which it discharges itself into the sea, is called by the natives the *Seven Seas*. Now the *Po*.

PADUS, in botany. See PRUNUS.

PÆAN, among the ancient pagans, was a song of rejoicing sung in honour of Apollo, chiefly used on occasions of victory and triumph. See APOLLO.

PÆAN, in the ancient poetry, a foot consisting of four syllables; of which there are four kinds, the pæan primus, secundus, &c.

The pæan primus consists of one long syllable and three short ones, or a trochæus and pyrrhichius, as *temporibus;* the pæan secundus consists of a short syllable, a long, and two short, or an iambus and a pyrrhichius, as *potentia;* the pæan tertius consists of two short syllables, a long and a short one, or a pyrrhichius and a trochæus, as *animatus;* the pæan quartus consists of three short syllables and a long one, or a pyrrhichius and iambus, as *celeritas*.

PÆDEROTA, in botany: A genus of the monogynia order, belonging to the pentandria class of plants; and in the natural [illegible] ranking under the 30th order, *Contortæ*. [illegible] ty, brittle, and dispermous; the [illegible]

PÆDO BAPTISM, [illegible] or that conferred on children; from [illegible] *infant*, and [illegible] *baptism*. This has been the subject of great controversy in the church. See ANABAPTISTS, BAPTISTS, &c.

PÆONIA, PIONY: A genus of the digynia order, belonging to the polyandria class of plants; and in the natural method ranking under the 26th order, *Multisiliquæ*. The calyx is pentaphyllous; the petals five; there are no styles; the capsules are polyspermous. There are two species, both of them very hardy, and will flourish in any common soil. They are large herbaceous flowery perennials, with tuberous roots, sending up strong annual stalks from one to three feet in height; terminated by very large flowers of a beautiful red colour, and much larger than any rose. The common officinal, or male piony, also is remarkable for its capsules turning backward, opening and displaying their red inside, together with the numerous seeds, in a singularly agreeable order, appearing very ornamental after the flower is past. The plants may be propagated either by parting the roots or by seed. This plant was formerly celebrated in nervous distempers, but the present practice pays very little regard to it.

PÆSTUM, called *Posidonia* by the Greeks, a town of Lucania, on the Sinus Pæstinus; an ancient colony prior to the first Punic war, according to Livy; but later, according to Velleius. *Pæstanæ rosæ* were in great esteem, and produced twice a-year (Virgil, Ovid).

PAGAN (Blaise Francois Comte de), an eminent French mathematician, was born at Avignon in Provence, March 3. 1604; and took to the profession of a soldier at fourteen, having been bred to it with the greatest care. In 1620 he was engaged at the siege of Caen, in the battle of Pont de Ce, and the reduction of the Navareins, and the rest of Bearn; where he signalized himself, and acquired a reputation far surpassing his years. He was present, in 1621, at the siege of St John d'Angeli, as also that of Clarac and Montauban, where he lost his left eye by a musket-shot. At this siege he had another loss, which equally afflicted him, viz. that of the constable of Luynes, who died there of a scarlet fever. The constable was a near relation, and had been his patron at court. He did not, however, sink under the misfortune, but on the contrary took fresh spirits from the necessity he was now in of trusting solely to himself. Accordingly there happened after this time neither siege, battle, nor any other occasion, in which he did not signalize himself by some effort of courage and conduct. At the passage of the Alps, and the barricade of Suza, he put himself at the head of the forlorn hope, consisting of the bravest youths among the guards; and undertook to arrive the first at the attack, by a private way which was extremely dangerous; when, having gained the top of a very steep mountain, he cried out to his followers, "See the way to glory!" He slipt along this mountain; and, his companions following him, they came first to the attack, as they wished to do. They immediately began a furious assault; and, the army coming to assist, they forced the barricades. He had afterwards the pleasure of standing on the left hand of the king, when his majesty related this heroic action to the Duke of Savoy with the deserved commendations, in the presence of a very full court. When the king laid siege to Nancy in 1633, our hero had the honour to attend his sovereign, in drawing the lines and forts of circumvallation. In 1642 his majesty sent him to the service in Portugal, in the post of field marshal. In this same year he unfortunately lost his eye sight by a distemper. But though he was thus disabled from serving his country with his conduct and courage, he reassumed, with greater vigour than ever, the study of the mathematics and fortification; and, in 1645, gave the public a treatise on this latter subject. It was allowed by all who understood the science, that nothing had then appeared that was preferable to it; and, indeed, whatever improvements have been made since, they have perhaps been derived chiefly from this treatise, as conclusions from their principles. In 1651 he published his Geometrical Theorems, which show a perfect knowledge of all the parts of the mathematics. In 1655 he printed A Paraphrase, in French, of the Account, in Spanish, of the River of the Amazons, by Father de Rennes, a Jesuit; and we are assured, that, though blind, he drew the chart of that river and the parts adjacent which is seen in this work. In 1657 he published The Theory of the Planets, cleared from that multiplicity of eccentric circles and epicycles, which the astronomers had invented to explain their motions. This work distinguished him among astronomers as much as that of fortifications did among engineers; and he printed, in 1658, his Astronomical Tables, which are very succinct and plain. Few great men are without some foible: Pagan's was that of a prejudice in favour of judicial astrology; and though he is more reserved than most others, yet we cannot put what he did on that subject among those productions which do honour to his understanding. He was beloved and respected by all persons illustrious for rank as well as science: and his house was the rendezvous of all the polite and worthy both in city and court. He died at Paris Nov. 18. 1665; and was never married. The king ordered

Pagan.

ordered his first physician to attend him in his illness, and gave several marks of the extraordinary esteem which he had for his merit.

He had an universal genius; and, having turned himself entirely to the art of war, and particularly to the branch of fortification, he made extraordinary progress in it. He understood mathematics not only better than is usual for a gentleman whose view is to push his fortune in the army, but even to a degree of perfection superior to that of the ordinary masters who teach that science. He had so particular a genius for this kind of learning, that he obtained it more readily by meditation than by reading authors upon it; and accordingly spent less time in such books than he did in those of history and geography. He had also made morality and politics his particular study; so that he may be said to have drawn his own character in his *Homme Heroique*, and to have been one of the completest gentlemen of his time. Louis XIII. was heard to say several times, that the Count de Pagan was one of the most worthy, best turned, most adroit, and most valiant men, in his kingdom.—That branch of his family, which removed from Naples to France in 1552, became extinct in his person.

PAGAN, a heathen, gentile, or idolater; one who adores false gods. See MYTHOLOGY.

PAGANALIA, certain festivals observed by the ancient Romans in the month of January. They were instituted by Servius Tullius, who appointed a certain number of villages *(pagi)*, in each of which an altar was to be raised for annual sacrifices to their tutelar gods; at which all the inhabitants were to assist, and give presents in money, according to their sex and age, by which means the number of country-people was known. The servants upon this occasion offered cakes to Ceres and Tellus, to obtain plentiful harvests.

PAGANELLUS, in ichthyology. See GOBIUS.

PAGANISM, the religious worship and discipline of pagans; or, the adoration of idols and false gods. See IDOLATRY, MYTHOLOGY, and POLYTHEISM.

PAGEANT, a triumphal car, chariot, arch, or other like pompous decoration, variously adorned with colours, flags, &c. carried about in public shows, processions, &c.

PAGI (Antony), a very famous Cordelier, and one of the ablest critics of his time, was born at Rogne in Provence in 1624. He took the habit in the convent at Arles in 1641, and was at length four times provincial of his order; but his religious duties did not prevent his vigorous application to the study of chronology and ecclesiastical history, in which he excelled. His most considerable work is, A Critique upon the Annals of Baronius; where, following the learned cardinal year by year, he has rectified an infinite number of mistakes both in chronology and in the representation of facts. He published the first volume in 1689, dedicated to the clergy of France, who allowed him a pension: the whole was printed after his death, in 4 vols folio, at Geneva, in 1705, by the care of his nephew Francis Pagi, of the same order. He wrote some other things before his death, which happened in 1699; and had the character of an able historian as well as of a learned and candid critic. His nephew Francis, above mentioned, wrote A Chronological Abridgment of the History of the Popes, in Latin, 3 vols 4to. Francis had also a nephew, Anthony Pagi, who added three more volumes to the History of the Popes; of which two more were intended, if not executed.



PAGNINUS (Sanctes), an Italian Dominican, eminent for his skill in Oriental languages and biblical learning, was born at Lucca in 1466, and became afterwards an ecclesiastic of the order of St Dominic. He was deeply and accurately skilled in Latin, Greek, Hebrew, Chaldee, and Arabic; but he was particularly excellent in the Hebrew. He applied himself to examine the vulgar translation of the Scriptures; and believing it to be either not of Jerome, or greatly corrupted, he undertook to make a new one from the present Hebrew text; in which he meant to imitate St Jerome, who set about making a new translation at a time when the church would admit no other but the Septuagint. This design of Pagninus, so early after the restoration of letters, seemed a bold one; yet such was the reputation of the man, that it was approved by Pope Leo X. who promised to furnish him with all necessary expences for carrying on the work: and, besides, we find at the beginning of this translation, which was printed at Lyons in 1527, two letters of the succeeding popes Hadrian VI. and Clement VII. which licensed the printing of it. Pagninus, in his Letters to Pope Clement, for the printing of this translation, openly declares, that the Vulgar edition, as it is at present, is not St Jerome's; yet adds, that he has retained in his translation as much of it as he could. It appears by a letter of Picus Mirandula to Pagninus, that he had spent 25 years upon this translation. It is the first modern translation of the Bible from the Hebrew text; and the Jews who read it affirmed, that it agreed exactly with the Hebrew, and was in some respects superior to the ancient translations. The great fault of Pagninus was, that he adhered with too great servility to the original text; and this scrupulous attachment made his translation, says Father Simon, "obscure, barbarous, and full of solecisms. He imagined, that to make a faithful translation of the Scriptures, it was necessary to follow exactly the letter according to the strictness of grammar. This, however, is quite contrary to his pretended exactness, because two languages seldom agree in their ways of speaking; and therefore, instead of expressing the original in its proper purity, he defaces and robs it of all its ornaments." Father Simon nevertheless allows the great abilities and learning of Pagninus; and all the later commentators and translators of the Scriptures have agreed in giving him his just praise. Huetius, though he thinks Father Simon's criticism of him just and well grounded, yet proposes his manner as a model for all translators of the sacred books: *Scripturæ interpretandæ rationis utile nobis exemplar proposuit Sanctus Pagninus.* He also translated the New Testament from the Greek, as he had done the Old from the Hebrew, laying the Vulgar all the while before him; and dedicated it to Pope Clement VII. He was author of an Hebrew Lexicon, and an Hebrew Grammar; which Buxtorf, who calls him *vir linguarum Orientalium peritissimus*, made great use of in compiling his. He died in 1536, aged 70. Luther spoke of him and his translations in terms of the highest applause.

Pago.

PAGO, an island in the gulph of Venice, separated from the continent of Morlachia by a narrow channel. The ancient geographers have left us no description of it; "though (as Fortis observes) its form (A), extent, and rich produce, unquestionably deserved it." And this is the more unaccountable, as we know the Romans were well acquainted with it; and on the other islands adjoining to it are many vestiges of buildings, inscriptions, tiles, and hewn stones, all sure signs of Roman habitations. Its ancient name was in all probability *Portunata*. "This island (says Mr Fortis *) is extended from north to south over against maritime Croatia, or the mountain Morlacca. It is about 50 miles long; its breadth is unequal. One particular circumstance distinguishes it from all the other islands of the Adriatic, and is a large internal salt water lake 15 miles long from south to north; into which the sea enters by a canal not above a quarter of a mile broad in some places. This lake is frequented by the tunny fish, which, when once in, cannot return again to the sea. There are also two smaller lakes on the island; one near Vlassich, abounding in fish, particularly eels; and one near the hamlet of Slabine.

* *Travels into Dalmatia.*

"In this island the winter is dreadfully cold, and the summer scorchingly hot. Those who have been there in the winter time speak of it as a Siberia quite covered with snow and ice, and always exposed to the cold north wind; I, who was there in the hot season, thought it equal to the most scorching parts of the world. The naked rocks, which not only form the organization, but also the superficies of almost all the island; the narrowness of the valleys; the reverberation of the water of the lake, generally quite calm in summer; multiply the heat so prodigiously among those stones, that the vines, which are planted all round the lake, ripen the grapes by the beginning of August; and the few other products that grow there anticipate the usual time of maturity in the same manner. The meteors are exceedingly irregular in the summer time; sudden whirlwinds are frequent, and heavy showers of rain: the last are hurtful to the inhabitants of one part of the island, and are favourable to the cultivation of the opposite end.

"They cultivate neither corn nor oil on this island; but it produces plenty of wine, and an immense quantity of salt. The other products are wool, honey, and a little salt fish. The quantity of wine amounts annually, on a medium, to 40,000 Venetian barrels; and from the husks they distil 2000 barrels of *rakia* or brandy. The salt, in 1663, amounted to 800,000 Venetian *stare*. The salt-works are well contrived and well kept: they extend along a shallow pool, which forms the eastern extremity of the lake within for four miles in length and about half a mile in breadth. On the sides of this fen the best part of the vines lie; but the upper part of the hills on each side is altogether naked and barren; there is not even a sufficiency of fire-wood, and the inhabitants are obliged to provide themselves elsewhere. The soil at the foot of the hills, where the vines are planted, is full of gravel and small stones: and hence the wine is of good quality. The air is not unhealthful, notwithstanding the vicinity of the salt-pits; but the frequent high winds carry off the noxious exhalations. The most considerable product of the island is the salt. The greatest part of the people of Pago live by working in the salt-pits, and have a comfortable subsistence regularly paid by the government: it is therefore a very important circumstance for the inhabitants of the city to have a dry summer; and hence the ignorant vulgar look upon rain as a mischief brought upon the country by the force of witchcraft. In consequence of this idea, they elect a friar to exorcise the meteors, and keep the rain off the island. If, notwithstanding the poor friar's endeavours, the summer happens to be rainy, he loses his reputation and his bread; but if two or three dry seasons follow successively, he meets with great reverence and advantage. Part of the salt-works belongs to the government, and the rest to private proprietors; they are meliorated every year; and for that end the public lends money to those proprietors who want it, and who without that assistance could not make the requisite improvements.

"Many vestiges of ancient habitations still remain on the island of Pago, as well as of walled places, which either have been destroyed by the incursions of enemies or by time. Historians say that the island was often abandoned by its inhabitants; and indeed it is rather to be wondered at how men ever could resolve to settle in so wretched a country. The small number of inhabitants, after so many years of peace and tranquillity under the Venetian government, evidently proves how little the island is really habitable. The town of Pago was built by the Venetians about 300 years ago; and contains upwards of 2000 inhabitants, and all the rest of the island scarcely 900. The difficulty of access to the city of Pago, and the ill accommodation



(A) Its figure is indeed remarkably irregular, its breadth being in no proportion to its length; for one of the extremities, called *Punta di Loni*, is above ten miles long, and less than one broad. Almost all the circumference is dismal, without trees or any kind of visible plants or grass, steep, craggy, and uninhabited. On entering the lake through the channel that communicates with the sea, nothing is to be seen either on the right or left but bare hanging rocks, so disfigured on the outside by the violent percussion of the waves, that the stratification is hardly distinguishable. In general, the stone of the island is of the same kind as the Istrian, or *breccia*; and, besides, there are large strata of blue and yellowish sand-stone. The channel, or inward bay of Pago, is not a harbour; on the contrary, it is a very dangerous station, and even inaccessible in winter, when the boreal wind blows with such fury, that the inhabitants of the town dare not stir out of their houses, and much less the few that are scattered over the country. The sky appears always cloudy in that season, by the thick mist that rises from the repercussion of the waves on that long chain of rough and hollow rocks.

commodation that strangers meet with, make it very little frequented. Hence the inhabitants are as wild and unpolished as if they lay at the greatest distance from the sea and the commerce of polite people. The gentry, who pretend to show their manners different from those of the vulgar, are truly grotesque figures, both in their dress, behaviour, and insolent pretensions. The ignorance of their clergy is incredible; a priest of the greatest consequence there, and who was thought a man of learning, did not know how Pago was called in Latin. There are two convents of friars in Pago and one of nuns; and several churches, all in very bad order, and ill served. At Terra Vecchia also there is a convent of Franciscan monks; a race of men who, under various names and disguises, infest every place where credulous ignorance can be persuaded to maintain the idle and superstitious. One superstitious custom, amongst a variety of others, exists among their women, and particularly among those who have been married but a short time: if their husband happens to die, they tear their hair out in good earnest, and scatter it on the coffin; and this ceremony is so much consecrated by ... though she had notori-

PAGOD, or PAGODA, a ... Indians to the temples where they worship their gods. We shall not in this place enter into a full detail of the several pagodas of different nations, and their peculiar circumstances. These matters seem to come in more properly under the *religion*, or, as others will call it, the *superstition*, of the people to whom they belong. We shall therefore content ourselves in the present article with an account of a paper in the *Asiatic Researches*, concerning the sculptures, &c. at Mavalipuram, a few miles north of Sadras, and known to seamen by the name of the *seven pagodas*.

The monuments which Mr Chambers (who communicated the paper) describes, appear, he says, to be the ruins of some great city decayed many centuries ago. "They are situated close to the sea, between Covelong and Sadras, somewhat remote from the high road that leads to the different European settlements. And when visited in 1776, there was still a native village adjoining to them which retained the ancient name, and in which a number of *bramins* resided that seemed perfectly well acquainted with the subjects of most of ... The rock, or rather ...

... they approach the coast, and to them the place known by the name of the *Seven Pagodas*, possibly because the summits of the rock have presented them with that idea as they passed: but it must be confessed that no aspect which the hill assumes as viewed on the shore, seems at all to authorise this notion; and there are circumstances, which will be mentioned in the sequel, that would lead one to suspect that this name has arisen from some such number of pagodas that formerly stood here, and in time have been buried in the waves." The rock here mentioned, as it rises abruptly out of a level plain of great extent, naturally engrosses the attention of the eye. It consists chiefly of a single stone; and in its shape (which is singular and romantic), in a distant view, it has the appearance of an antique and lofty edifice. Works of imagery and sculpture crowd thicker upon the eye on a nearer approach, and at first sight at least favours the idea of a petrified town, which, through the credulity of travellers*, has been supposed to exist in various parts of the world. "Proceeding on by the foot of the hill on the side facing the sea, there is a pagoda rising out of the ground of one solid stone, about 16 or 18 feet high, which seems to have been cut upon the spot out of a detached rock that has been found of a proper size for that purpose. The top is arched, and the style of architecture according to which it is formed, different from any now used in those parts." Beyond this a numerous group of human figures in bass relief, considerably larger than life, attract attention. They represent considerable persons, and their exploits, many of which are now very indistinct thro' the injuries of time, assisted by the corroding nature of the sea air; others, while protected from that ele-

... The hill, which is at first of easy ascent, ... other parts rendered more so, by very excellent steps cut out in several places, where the communication would be difficult or impracticable without them. A winding stair of this sort leads to a kind of temple cut out of the solid rock, with some figures of idols in high relief upon its walls, very well finished and perfectly fresh, as it faces the west, and is therefore sheltered from the sea air." This temple our author conjectures to have been a place of worship appertaining to a palace; some remains of which still exist, and to which there is a passage from the temple by another flight of steps. This conjecture (for it is brought forward as merely such) is in some measure favoured by several ruins still remaining, and by the tradition of the bramins who inhabit the place. This finishes the objects "on that part of the upper surface of the hill, the ascent to which is on the north; but on descending from thence, you are led round the hill to the opposite side, in which there are steps cut from the bottom to a place near the summit, where is an excavation that seems to have been intended for a place of worship, and contains various sculptures of Hindoo ...

... figure of *Vishnou* (A), asleep on a kind of bed, with a huge snake wound about in many coils by way of pillow for his head; and these figures, according to the manner of this place, are all of one piece hewn from the body of the rock." These works, however, although they are unquestionably stupendous, are, in our author's opinion, surpassed by others about a mile and a half to the southward of the hill. "They consist of two pagodas of about 30 feet long by 20 feet wide, and about as many in height, cut out of the solid rock, and each consisting originally of one single stone. Near these also stand an elephant full as big as life, and

* See Shaw's *Travels*, 155, &c.

(A) See a figure of *Vishnou* in the plate of Indian gods, with its description, under the article POLYTHEISM.

Pagod. and a lion much larger than the natural size, but very well executed, each hewn also out of one stone. None of the pieces that have fallen off in cutting these extraordinary sculptures are now to be found near or any where in the neighbourhood of them, so that there is no means of ascertaining the degree of labour and time that has been spent upon them, nor the size of the rock or rocks from which they have been hewn; a circumstance which renders their appearance the more striking and singular. And though their situation is very near the sea-beach, they have not suffered at all by the corrosive air of that element, which has provided them with a defence against itself, by throwing up before them a high bank that completely shelters them. There is also great symmetry in their form, though that of the pagodas is different from the style of architecture according to which idol temples are now built in that country. The latter resembles the Egyptian; for the towers are always pyramidical, and the gates and roofs flat and without arches; but these sculptures approach nearer to the Gothic taste, being surmounted by arched roofs or domes that are not semicircular, but composed of two segments of circles meeting in a point at top." Our author observes, that the lion in this group, as well as one on a stone couch in what he took to be a royal palace, are perfectly just representations of the true lion; and the natives there give them the name which is always understood to mean a lion in the Hindoo language, to wit, *sing*; but the figure which they have made to represent that animal in their idol temples for centuries past, though it bears the same appellation, is a distorted monster totally unlike the original; insomuch that it has from hence been supposed, that the lion was not anciently known in this country, and that *sing* was a name given to a monster that existed only in Hindoo romance. But it is plain that that animal was well known to the authors of these works, who, in manners as well as arts, seem to have differed much from the modern Hindoos.

" There are two circumstances attending these monuments which cannot but excite great curiosity, and on which future inquiries may possibly throw some light. One is, that on one of the pagodas last mentioned, there is an inscription of a single line, in a character at present unknown to the Hindoos. It resembles neither the Deyva-nâgre, nor any of the various characters connected with or derived from it, which have come to the writer's knowledge from any part of Hindostan. Nor did it, at the time he viewed it, appear to correspond with any character, Asiatic or European, that is commonly known. He had not then, however, seen the alphabet of the Balic, the learned language of the Siamese, a sight of which has since raised in his mind a suspicion that there is a near affinity between them, if the character be not identically the same. But as these conjectures, after such a lapse of time, are somewhat vague, and the subject of them is perhaps yet within the reach of our researches, it is to be hoped that some method may be fallen upon of procuring an exact copy of this inscription.

" The other circumstance is, that though the outward form of the pagodas is complete, the ultimate design of them has manifestly not been accomplished, but seems to have been defeated by some extraordinary convulsion of nature. For the western side of the most northerly one is excavated to the depth of four or five feet, and a row of pillars left on the outside to support the roof; but here the work has been stopped, and an uniform rent of about four inches breadth has been made throughout the solid rock, and appears to extend to its foundations, which are probably at a prodigious depth below the surface of the ground. That this rent has happened since the work began, or while it was carrying on, cannot be doubted; for the marks of the mason's tools are perfectly visible in the excavated part on both sides of the rent, in such a manner as to show plainly that they have been divided by it. Nor is it reasonable to suppose, that such a work would ever have been designed or begun upon a rock that had previously been rent in two. Nothing less than an earthquake, and that a violent one, could apparently have produced such a fissure in the solid rock: and that this has been the case in point of fact, may be gathered from other circumstances, which it is necessary to mention in an account of this curious place. The great rock above described is at some small distance from the sea, perhaps 50 or 100 yards, and in that space the Hindoo village before mentioned stood in 1776. But close to the sea are the remains of a pagoda built of brick, and dedicated to Sib, the greatest part of which has evidently been swallowed up by that element; for the door of the innermost apartment, in which the idol is placed, and before which there are always two or three spacious courts surrounded with walls, is now washed by the waves, and the pillar used to discover the meridian at the time of founding the pagoda is seen standing at some distance in the sea. In the neighbourhood of this building there are some detached rocks, washed also by the waves, on which there appear sculptures, though now much worn and defaced. And the natives of the place declared to the writer of this account, that the more aged people among them remembered to have seen the tops of several pagodas far out in the sea, which being covered with copper (probably gilt) were particularly visible at sun-rise, as their shining surface used then to reflect the sun's rays, but that now that effect was no longer produced, as the copper had since become incrusted with mould and verdegrease."

From these circumstances our author conjectures, and we think reasonably, that the magnificent city of which these appear to be part of the ruins, has been destroyed partly by an earthquake, by which the rock was rent, and partly by a sudden inundation of the sea, occasioned by this commotion of the earth. The bramins give an account of this matter peculiar to themselves, filled with extravagance, fable, and folly; from which, however, with the assistance of ancient monuments, coins, and inscriptions, some probable conjectures at least, if not important discoveries, may, it is hoped, be made on these subjects, which are far from being uninteresting to us either as men, philosophers, or Christians. Our author thinks, therefore, that the inscription on the pagoda mentioned above is an object which merits considerable attention; and he defends, by very reputable authorities, the conjecture which places it among the languages of *Siam*; but which it is unnecessary for us either to abridge or to transcribe. In the course of this inquiry,

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inquiry, our author remarks a very near reſemblance between *Sommonacodom*, the idol of the *Siameſe*, and the great idol Buddou, held ſacred by the *Chingelays;* and this reſemblance extends alſo to their prieſts. But from the detail of circumſtances which our author brings forward, and to which we refer, he thinks this a ſyſtem of religion different from that of the *Veds*, and ſome of them totally inconſiſtent with the principles and practice of the *bramins;* none of whom, as far as we can collect from Mr Knox †, exiſt among the Chingelays, whoſe religion is totally different from that of the preſent Hindoos. The only part in which there ſeems to be any agreement is in the worſhip of the Debtahs, which has probably crept in among them from the Tamulian neighbours, but that is carried on in a manner very different from the braminical ſyſtem, and appears to be held by the nation at large in very great contempt, if not abhorrence. Knox's account of it is this: "Their temples (*i. e.* thoſe of the Debtahs) are called *covels*," which is the Tamulic word for pagoda. He then goes on to ſay, "a man piouſly diſpoſed builds a ſmall houſe at his own charge, which is the [illegible] and himſelf becomes prieſt thereof. This hou[illegible] ſeldom called *God's Houſe*, but moſt uſually *Jac*[illegible] *Devil's*." But of the prevailing religion he ſpeaks in very different terms, and deſcribes it as carried on with much parade and ſplendour, and attended with marks of great antiquity. "The pagodas or temples of their gods (ſays he) are ſo many, that I cannot number them. Many of them are of rare and exquiſite work built of hewn ſtone, engraven with images and figures, but by whom and when I could not attain to know, the inhabitants themſelves being ignorant therein. But ſure I am they were built by far more ingenious artificers than the Chingelays that now are on the land. For the Portugueſe in their invaſions have defaced ſome of them, which there is none found that hath ſkill enough to repair to this day." In another place, he ſays, "here are ſome ancient writings engraven upon rocks which puzzle all that ſee them. There are divers great rocks in divers parts in Cande Uda, and in the northern parts. Theſe rocks are cut deep with great letters for the ſpace of ſome yards, ſo deep that they may laſt to the world's end. No body can read them or make any thing of them. I have aſked Malabars and Gentoos, as well as Chingelays and Moors, but none of them underſtood them. There is an ancient temple, Goddiladenni in Yattanour, ſtands by a place where there are of theſe letters." From all which the antiquity of the nation and their religion is ſufficiently evident, and from other paſſages it is plain, that the worſhip of Buddou, in particular, has been from remote times a very eminent part of their religion; for the ſame author, ſpeaking of the tree at Anurodgburro, in the northern part of the iſland, which is ſacred to Buddou, ſays, "the due performance of this worſhip they reckon not a little meritorious: inſomuch that, as they report, 90 kings have reigned there ſucceſſively, where, by the ruins that ſtill remain, it appears they ſpared not for pains and labour, to build temples and high monuments to the honour of this god, as if they had been born to hew rocks and great ſtones, and lay them up in heaps. Theſe kings are now happy ſpirits, having merited it by theſe labours." And again he ſays, "For this god, above all other, they ſeem to have an high reſpect and devotion," &c.

† *Hiſt. of Ceylon.*

Such is the nature of Mr Chambers's communication, as far as it reſpects pagodas; a ſubject to which the *Aſiatic Society* will doubtleſs again direct their attention; and from the penetration and aſſiduity of its members we have much to expect. Other parts of this paper ſhall be brought forward under other articles, to which we refer. Few reſearches are of more ſervice to true religion, than thoſe which give us a correct view of the falſe and ſuperſtitious modes of worſhip practiſed by men who have had no light but reaſon, or weak and corrupted traditions. They are uſeful likewiſe to the philoſopher, as they always tend to give us a minuter view of the real nature of man as he is in himſelf, and ſhow with ſufficient ſtrength the imbecillity of the human intellect without ſome ſupernatural aid. The external pomp of all Pagan religions ſeems to have been their eſſence; a circumſtance which alone ſhows the neceſſity of that, the intention of which is to reform the heart. See Siam, Sommonacodon, Temple, &c.

Pagod, Pain

Pagod, or *Pa*[illegible] alſo the name of a gold and ſilver coin, [illegible] parts of the Eaſt Indies.

Pain, [illegible]iour, ariſing from a ſudden and viol[illegible]ntinuity, or other accident in the nerves, [illegible] veſſels, muſcles, &c. of the body. Pain, according to ſome, conſiſts in a motion of the organs of ſenſe; and, according to others, it is an emotion of the ſoul occaſioned by thoſe organs.

As the brain is the ſeat of ſenſation, ſo it is of pain. Boerhaave, and moſt other authors on [illegible]ect, aſſign a ſtretching of the nerves as the [illegible]te cauſe of pain: but as the nerves do not [illegible] conſiſt of fibres, this cauſe of pain does not [illegible] well-founded; nor indeed will it be eaſy to treat this ſubject clearly, but in proportion as the means of ſenſation are underſtood.

Many kinds of pain are met with in authors: ſuch as, A gravitative pain; in which there is a ſenſe of weight on the part affected, which is always ſome fleſhy one, as the liver, &c. A pulſative pain; which, Galen ſays, always ſucceeds ſome remarkable inflammation in the containing parts, and is obſerved in abſceſſes while ſuppurating. A tenſive pain, which is alſo called a *diſtending* pain; it is excited by the diſtenſion of ſome nervous, muſcular, or membranous part, either from ſome humour, or from flatulence. An acute pain is, when great pain is attended with quick and lively ſenſations: A dull pain is, when a kind of numbneſs is as much complained of as the pain is.

The mediate and more remote cauſes of pain are generally obvious; and when ſo, the cure will conſiſt for the moſt part in removing them: for though in many inſtances the chief complaint is very diſtant from the ſeat of theſe cauſes, yet their removal is the proper method of relief. See Medicine, *paſſim*.

Perhaps all pains may be included, with irritation, in thoſe that have ſpaſm or inflammation for their ſource. When pain is owing to inflammation, the pulſe is quicker than in a natural ſtate; it is alſo generally full, hard, and tenſe; the pain is equal, throbbing, and unremitting. If a ſpaſm is the cauſe, the pulſe is rarely affected; at intervals the pain abates, and then returns with

Pain.

with some degree of aggravation; gentle motion sometimes abates, or even cures, in some instances: but in inflammatory cases no such effects are ever experienced. See Dr Lobb's *Treatise on Painful Distempers*.

The pain so frequently attendant on women in childbed, called *after-pains* (from their happening only after being delivered of a child), are often occasioned by scooping to fetch away coagulated blood, which is a needless endeavour. When no improper treatment in delivering the secundines can be suspected, the irritability of the uterus alone is to be considered as the cause. Care should be taken not to confound these after-pains with, or mistake the pains attending puerperal fevers for, the colic. After pains come by fits, and soon go off; but return at different intervals, which are longer each day, and after two or three days are usually at an end, though sometimes they continue seven or eight: notwithstanding these pains, the lochia flow properly and generally more abundantly after the cessation of each fit; this does not happen in cholicky complaints, nor is the belly so free from tumefaction when the puerperal fever is attendant.

As these pains are of the spasmodic kind, anodynes and gentle opiates, with frequent draughts of warm caudle, camomile tea, &c. are all that are required in order to their relief.

Among the various causes of pain, a singular one is related in the third vol. of the *Lond. Med. Obs. and Inq.* p. 241, &c. Some persons who had taken cold during their being salivated, were afflicted with pains which resisted all the usual methods of relief. At length the author of the narrative referred to suggested the cause; and by exciting a fresh salivation the pains abated: the spitting was kept up a little while, and permitted to abate with some caution; and thus the cures were completed.

# PAINTING.

PAINTING is the art of [illegible] things, by means of figures and [illegible] object in nature that is discernible by the [illegible] of sometimes expressing, according to the principles of physiognomy, and by the attitudes of the body, the various emotions of the mind. A smooth surface, by means of lines and colours, represents objects in a state of projection; and [illegible] represent them in the most pleasant dress, and in a manner most capable of enchanting the senses. Still higher, the objects which delight us by their animation and lively colours, speak to the soul, by giving us the image of what we hold most dear, or by indicating an action which inspires us with a taste for innocent pleasures with courage, and with elevated sentiments. Such is the definition, and such are the effects of painting.

By an admirable effort of human genius, painting offers to our eyes every thing which is most valuable in the universe. Its empire extends over every age and country. It presents to us the heroic deeds of ancient times as well as the facts in which we are more conversant, and distant objects as well as those which we daily see. In this respect it may be considered as a supplement to nature, which gives us only a view of present objects.

The art of painting is extremely difficult in the execution; and its merit can only be appreciated by those who profess the art.

The painter who invents, composes, and colours conceptions which are only agreeable, and which speak merely to the eye of the spectator, may be reckoned to possess the first merit in the style of embellishment and decoration.

The painter who is distinguished for noble and profound conceptions; who, by means of a perfect delineation, and colours more capable of fixing the attention than dazzling the eye, conveys to the spectators the sentiments with which he himself was inspired; who animates them with his genius, and makes a lasting impression on their minds; this artist is a poet, and worthy to share even in the glories of Homer. [illegible] in forming this great idea of his art that the painter becomes himself great.

But if he seek only to please or astonish by the illusion of colours, he must rest contented with the secondary merit of flattering the eye with the variety and opposition of tints, or of making an industrious assemblage of a great multiplicity of objects. It is in painting as it is in poetry. The man who clothes trivial or common ideas in verse, exercises the profession of twisting syllables into a certain measure. The poet who clothes in good verse ideas and sentiments, that are merely agreeable, professes an agreeable art. But he who by the magic of verse, of ideas, of imagery, or of colours, adds sublimity to the sublime objects of nature, is a great poet and a great painter. He deserves the crown which the nations have decreed to Homer, Virgil, Milton, Raphael, and the statuary who modelled the ancient Apollo. It is reasonable to place in the same class those who have expressed the same ideas, whether it be in verse or in colours, on brass or on marble. The painter and statuary, who excel in their professions, deserve all the respect due to genius: they are of the number of those men whom nature, sparing of her best gifts, grants but occasionally to the inhabitants of the earth. If they are sublime, they elevate the human race; if they are agreeable only, they excite those sweet sensations necessary to our happiness.

In laying before our readers a succinct account of this noble art, we shall, first, give the history of painting, including its rise, progress, and decline, in ancient and modern times; an account of the schools, and of the different merits of painters; and a comparison between the ancient and modern painting. Secondly, we shall lay down the principles of the art, and the order in which the artist conducts his studies. Thirdly, we shall enumerate the different classes of painting, with observations on each. And, Fourthly, we shall treat of œconomical or house-painting.

HISTORY.

Rise, Progress, and Decline

## HISTORY.

### Sect. I. *Rise, Progress, and Decline of Painting in Ancient and Modern Times.*

It is to be imagined that men must naturally, and very early, have conceived an idea of the first principles of the art of painting; the shadow of each plant and animal, and of every object in nature, must have afforded them the means of conceiving, and pointed out the possibility of imitating, the figures of all bodies. Thus the savage nations, an emblem of what men were in the infancy of society, possess the first rudiments of this art, even before those which are useful and almost necessary to existence; their naked bodies are covered with punctures of various forms, into which they infuse indelible colours. The next demand for this art, is to preserve the memory of warlike exploits. It is more natural to form some representation of an action, than to give an account of it by means of arbitrary characters. Hence the picture-writing of the Mexicans, and the more artful hieroglyphics of Egypt.

Painting consisted of simple outlines long before the expression of relievo or the application of colour. It was simply drawing; and the master-pieces of painting in that rude period were not superior to the sports of children. Although occupied about a single point, it was not brought to perfection; for constant experience instructs us that men never excel in the inferior parts of an art till they are capable of carrying the whole to perfection.

After employing for a long time those simple outlines, the next step in the art of painting was to make the imitation more complete, by applying colours: this was first accomplished by covering the different parts of the figure with different colours in the same way that we colour maps; and several nations, as the Egyptians, the Chinese, and the different nations of India, have never painted in a better manner. Other nations, more ingenious and more attentive to the arts, observing that the objects of nature have relievo, have invented what is called *claro-obscuro*. The Greeks, the most ingenious, penetrating, and delicate of all, invented this part antecedent to colours; than which there cannot be a greater proof of their exquisite taste, as the glare of colours without judgment excites more admiration in the minds of the vulgar and ignorant, than the camaieu or drawings of one colour executed by the most skilful artist.

These general observations concerning the gradual improvement of this art, will be best illustrated by a more particular attention to the ancient nations in which it flourished.

Painting among the Egyptians.

Plato, who lived 400 years before the Christian era, informs us that painting had been practised in Egypt for ten thousand years; that some of the productions of that high antiquity were in existence; and that they bore an exact resemblance to those which the Egyptians executed in his time. Without regarding the period of ten thousand years mentioned by Plato, it is reasonable to consider it as an indeterminate period, which carries us back to very remote antiquity.

The figures either in the painting or sculpture of Egypt were extremely stiff; the legs were drawn together, and their arms were pasted to their sides. It appears that there only model was their mummies, and that their skill in anatomy was derived from embalming them. They were extremely incorrect in every part of the head; they placed the ears much higher than the nose. Besides, they gave the face the form of a circle instead of an oval; the chin was short and rounded; the cheeks excessively so; and they turned upwards the corners of the mouth and eyes. Many of these faults may be ascribed to the formation of the human face in Egypt; but the placing of the ears could only be founded in caprice or ignorance.

The exactness of the Egyptian proportion is much celebrated; but although we grant that they observed the proper length of the different parts of the human body, they were still defective artists, since they did not observe the breadth, and were moreover ignorant altogether of the shape and size of the muscles. Works converted to religious purposes chiefly occupied the Egyptian painters. They had figures for imitation from which they would not depart, and those figures were monstrous; the bodies of animals with the heads of men; the bodies of men with the heads of animals: or if the figure was more agreeable to nature in its parts, yet it was so deformed and imaginary, as to have nothing similar to it as a whole in the creation of God.

The monuments of Egyptian painting with which we are best acquainted (says Winklemann) are the chests of mummies. These works have resisted the injuries of time, and are still submitted to the examination of the curious. The white, made of white lead, is spread over the ground of the piece; the outlines of the figure are traced with black strokes, and the colours, are four in number; namely, blue, red, yellow, and green, laid on without any mixture or shading. The red and blue prevail most; and those colours seem to have been prepared in the coarsest manner. The light is formed by leaving those parts of the ground where it is necessary, covered with the white lead, as it is formed by the white paper in some of our drawings. This description is sufficient to convince us that the whole art of painting in Egypt consisted in colouring: but every person knows, that without tints and the mixture of colours painting can never arrive at great perfection.

In Upper Egypt there seems to have existed a kind of colossian painting, which has never been examined except by travellers who were no great critics in the art. Winklemann had some reason to express a desire that those remains of antiquity, with regard to the manner of working, the style, and the character, had been accurately explored. Walls of 24 feet in height, and pillars of 32 feet in circumference, are wholly covered with those colossian figures. According to Norden they are coloured in the same manner with the mummies: the colours are applied to a ground prepared in manner of fresco; and they have retained their freshness for many thousand years. Winklemann adds, that all the efforts of human skill and industry could make

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make as little impression on them as the injuries of time. His enthusiasm for antiquity has perhaps led him into this extravagant exaggeration.

It appears that the great employment of the Egyptian painters was on earthen vessels, on drinking cups, in ornamenting barges, and in covering with figures the chests of mummies. They painted also on cloth; but painting, as an industrious occupation, supposes a workman, not an artist: the decoration of temples, house-painting, and that of the figures relative to religion, are to be considered only in this point of view. The workmen in Russia who paint our Saviour holding the globe in one hand, and blessing the people with the other, are not members of the imperial academy of fine arts.

Pliny informs us that the Egyptian artists painted also the precious metals; that is to say, they varnished or enamelled them. It is doubtful what this art was, but most probably it consisted in covering gold or silver with a single colour.

The Egyptians are supposed to have continued this coarse style till the reign of the Ptolemies.

2
In Persia.

The Persians were so far from excelling in the arts, that the paintings of Egypt were highly esteemed among them after they had conquered that country.

The carpets of Persia were in great value in Greece, even in the time of Alexander the Great, and these were adorned with various figures; but this is no proof that they were well executed, any more than a demand for several of the Chinese productions is at present a proof of the taste of that people in the arts. It was the fabrication of the silk, and not the truth of the representation, which made the Greeks admire the carpets of the Persians.

The Persians, as well as the Arabians, had some knowledge of Mosaic work. This is only valuable when it copies, in a manner that cannot be destroyed, the works of a great master; but if the Persians had no good pictures to copy into Mosaic, it was of no consequence to be able to arrange, in a solid manner, pieces of flint one beside another.

There is only one Persian painter whose name has descended to posterity; and he is preserved, not because he was a painter, but because he accommodated the ancient doctrine of the two principles to the Christian religion. Besides, it is doubted whether *Manes* was a Persian or a Greek, and it is still less known whether he was a painter. He is praised in Asia for drawing straight lines without a ruler.

The modern Persians have made no kind of progress in the arts. The emperor Schah abbas, wishing from caprice to be instructed in drawing, was obliged to have recourse to a Dutch painter who happened to be in his dominions.

3
In India and Thibet.

The modern Persians paint on cloth, and the artists in India are their rivals in this branch of industry; but their paintings are purely capricious. They represent plants and flowers which have no existence in nature; and their only merit consists in the brightness and the strength of their colours.

Besides this, the art in India, as it was in the most remote antiquity, is confined to monstrous figures connected with their religion, animals not to be found in the world, and idols with a multitude of arms and heads, which have neither exactness in their forms nor proportions. See POLYTHEISM.

The paintings of Thibet discover great patience in the artist, and are remarkable for the fineness of their strokes. Their painters might dispute with Apelles and Protogenes for extreme tenuity of pencil; but it is in this alone, without any regard to the art, in which their merit consists.

Some of the idols in Thibet are executed in a certain style of relievo; but those productions are not only imperfect, they are also so destitute of beauty as to forbid every hope of excellence in the art. The same thing may be observed with regard to many of the eastern nations; they seem to have that want of style which would for ever condemn them to mediocrity, even if they should happen to arrive at it.

4
In China.

An obscure Italian painter named *Giovani Ghirardini*, who travelled into China, whose judgment is more to be depended on in an art which he practised than that of other travellers, declares that the Chinese have not the least idea of the fine arts; and this opinion is confirmed by every thing which we know of that people.

The Chinese seem not to have the smallest conception of perspective. Their landscapes have no plan, no variety in the appearance of the clouds, and no diminishing of the objects in proportion to their distance.

The great object of their painting seems to consist in making their figures as unlike nature as possible; it is a serious caricature of the human figure.

To make the art flourish, it is necessary that the artist be esteemed and rewarded. In China, there is no artist so poorly paid as the painter.

The ignorant admire the brightness and purity of their colours; but simple colours appear always bright and pure: The difficulty of the art consists in melting them into one another in such a manner that the mixture shall not be perceived. It must at the same time be confessed, that their natural colours are more brilliant than ours; but if there be any merit in this, it is to be ascribed to their climate, not to their ability.

A Jesuit missionary, who in his youth had been a grinder of colours, was raised to the greatest eminence as a painter in the Imperial court of China, and Raphael himself was never so much respected. The Chinese battles sent from that country to Paris to be engraved, are the work of the Jesuits; and except they were done by the Chinese themselves, it is impossible to conceive that they could be worse executed.

The Chinese, like other eastern nations, have a few simple strokes which they repeat in all their variety of figures. In the figures on the earthen ware, they discover no knowledge of forms, no expression of the most conspicuous muscles, and no idea of proportion. And in all the paintings of China, anatomy seems to bear no relation to the art. Some heads done by a Chinese painter have a sort of resemblance to nature, but they are in a low and vicious taste: The fulness of the drapery conceals the parts in such a manner that they do not seem to exist under it. Sculpture in China is in a state of no great perfection, but at the same time it is better executed than their paintings.

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The ancient inhabitants of Etruria, now called *Tuscany*, were the first who connected the arts with the study of nature. In some of their monuments which still remain, there is to be observed a first style, which shows the art in its infancy; and a second, which, like the works of the Florentine artists, shows more of greatness and exaggeration in the character than precision or beauty.

5 In Etruria.

Pliny says that painting was carried to great perfection in Italy before the foundation of Rome; perhaps he means in comparison with the infancy of the art in Greece at that period; but it appears that even in his time the painters of Etruria were held in great reputation.

The only Etrurian paintings which remain, have been found in the tombs of the Tarquins. They consist of long painted frizes, and pilasters adorned with huge figures, which occupied the whole space from the base to the cornice. These paintings are executed on a ground of thick mortar, and many of them are in a state of high preservation.

6 In Campania.

Winklemann is of opinion that the Greek colonies established at Naples and Nola, had at a very early period cultivated the imitative arts, and taught them to the Campanians established in the middle of the country. This learned antiquarian considers as works purely Campanian, certain medals of Capua and Teanum, cities of Campania into which the Greek colonies never penetrated. The head of a young Hercules, and the head of a Jupiter, according to Winklemann, are executed in the finest manner. It is still a question, however, in the learned world, whether these medals owe their existence to Carthage or to Campania.

"But there has been discovered (adds Winklemann) a great number of Campanian vases covered with painting. The design of the greatest part of these vases (says he) is such, that the figures might occupy a distinguished place in a work of Raphael. Those vases, when we consider that this kind of work admits of no correction, and that the stroke which forms the outline must remain as it is originally traced, are wonderful proofs of the perfection of the art among the ancients." Winklemann had an opportunity of examining a very fine Campanian vase, on which was painted a burlesque representation of the loves of Jupiter and Alcmene. But as this must have been derived from some fragment of a Grecian comedy, the Count de Caylus is persuaded that the Campanian vases are of Greek origin.

7 Among the Greeks.

Although the history of Greek painting be more fully known than that of the same art among the barbarous nations, it is nevertheless involved in much obscurity. Pliny is almost the only author who has preserved the materials of its history; and he complains, that on this occasion the Greek writers have not discovered their usual exactness. They place, says he, the first painter of whom they speak in the 90th Olympiad, 424 years before the Christian era. It is certain that painting in dry colours existed at the time of the siege of Troy, or at least when Homer wrote the account of it. The buckler of Achilles is a sufficient proof that the Greeks were then acquainted with the basso-relievo, a kind of sculpture which bears a near affinity to painting.

In the Iliad, Helen is represented as working at a tapestry, whereon she figured the numerous combats of which she was the cause. When Andromache was informed of her husband's death, she was occupied in representing on tapestry flowers of various colours. From these facts, it is certain that painting was not confined to simple strokes, nor even to the camaieu; and hence it is reasonable to conclude, that what is called *linear painting* was practised long before the time of Homer. Polygnote of Thasos, who lived about 420 years before the Christian era, was the first painter of any eminence in Greece. Pliny informs us that he was the first who clothed his female figures, who varied the colours of the different parts of their dress, or who opened their mouths in such a manner as to show their teeth. Aristotle, who flourished in a subsequent period, allows this painter to have excelled in expression. But the art of painting may be still considered in its infancy in Greece, till about 400 years before the Christian era, when Zeuxis and Parrhasius flourished. In the contest between these eminent painters, Zeuxis declared himself to be overcome, because in a cluster of grapes which he painted he had deceived the birds; whereas Parrhasius in a curtain which he executed deceived his rival. The principal works of Zeuxis are his *Penelope*, in which, according to Pliny, he appears to have expressed the manners of that princess; a Jupiter surrounded by the gods; a Hercules strangling the serpents in the presence of Amphitrion and Alcmene; an Helen and a Marsyas bound. From this enumeration of these works, and from the fame which they have acquired, it is evident that the difficult parts of the art, and those which in the execution render it estimable, were now begun to be studied. By Apelles, Protogenes, and Euphranor, it was carried to the greatest height of perfection. Grace, and symmetry, and proportion, and illusion, were now added by the greatest masters to the noblest objects of nature.

We have already seen, that before the foundation of Rome the arts were cultivated in Etruria. They were also early introduced into Latium; but whether that country employed its own artists or those of Etruria, remains altogether uncertain. One need not be astonished, that at a period when the arts were in their infancy in Greece, they were raising statues to their kings in Rome: but at that period all their artists were Etrurians or Latins; and when they conquered Italy, they made all the nations of it as barbarous as they were themselves. 8 Among the Romans.

In the year 259 from the building of the city of Rome, and 494 years before the Christian era, Appius Claudius consecrated a number of shields in the temple of Bellona, which contained in basso relievo the portraits of his family. This example was followed; and in process of time it was common among the Romans to place those images in private houses. The execution in basso-relievo is a proof that they had an idea of painting, at least with one colour. As long as the Romans employed artists of other nations, they had little desire to cultivate the arts; but towards the year of Rome 450, and 303 years before Christ, one of the Fabii thought it no discredit to a noble family to employ himself in painting. He painted the temple of Safety; and his works remain-

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ed till that temple was destroyed by fire, in the reign of Claudius. It is worthy of remark, that the same man was the first painter and the first historian in his country.

The example of Fabius, surnamed *Pictor* from his profession, did not excite his fellow citizens to imitation. A century and a half elapsed before the tragic poet Pacuvius, nephew of Ennius, painted the temple of Hercules in the *forum boarium*. The glory which he had acquired by his dramatic works shed some lustre on the art, which he condescended to exercise; but did not confer on it that respect which could recommend it to general practice. The paintings of Fabius were the works or rather the recreations of his youth; those of Pacuvius, the amusements of his old age; but painting is a difficult art, which requires the whole attention, and which can never be prosecuted with success, except those who love it are solely devoted to the performance.

It appears that there were no eminent painters at Rome till the time of the emperors; but as the national spirit was changed, the profession of the fine arts acquired more respectability. The Romans, during the time of the republic, were animated with the spirit of liberty and the desire for conquest. When these two passions were weakened, the love of the arts obtained among them. As a proof of this it is sufficient to say, that Nero himself gloried in being an artist. A Colossian picture of 120 feet was painted at Rome by the command of this emperor, which was afterward destroyed by lightning. The name of the painter is not recorded, and there are various opinions concerning the merit of the performance; but the thing chiefly worthy of observation is, that this is the only painting on cloth mentioned by ancient authors.

9 Of the modes of painting among the ancients.

The paintings of the ancient artists were either moveable or on the ceilings or compartments of buildings. According to Pliny, the most eminent were those who painted moveable pictures. The latter were either on fir-wood, larch, boxwood, or canvas, as in the colossian picture mentioned above, and sometimes on marble. When they employed wood, they laid on in the first instance a white ground. Among the antiquities of the Herculaneum are four paintings on white marble.

Their immoveable paintings on walls were either in fresco or on the dry stucco in distemper. Indeed all the ancient paintings may be reduced to, *first*, fresco painting; *secondly*, water-colour or distemper painting on a dry ground; and, *thirdly*, encaustic painting.

The ancient fresco-paintings appear to have been always on a white stucco-ground, the colours inlaid very deep, and the drawing much more bold and free than any similar performance of modern art. The outlines of the ancient paintings on fresco were probably done at once, as appears from the depth of the incision and the boldness and freedom of the design, equal to the care and spirit of a pencilled outline.

In general the ancients painted on a dry ground, even in their buildings, as appears from the Herculanenan antiquities, most of which are executed in this manner. At Rome and Naples, the first (deepest) coat is of true Puzzolana, of the same nature with the *terras* now used in mortar, required to keep out wet, about one finger thick; the next of ground marble or alabaster, and sometimes of pure lime or stucco, in thickness about one third of the former. Upon this they appear to have laid a coat of black, and then another of red paint; on which last the subject itself was executed. Such seems to have been their method of painting on walls; but in their moveable pictures, and in the performance of their first artists, and where effect of shade and light were necessary, they doubtless used white.

The colours employed they seem to have mixed up with size, of which they preferred that made by boiling the ears and genitals of bulls. This appears to have made the colours so durable and adhesive, that the ancient paintings lately found bear washing with a soft cloth and water; and sometimes even diluted aquafortis is employed to clean their paintings on fresco. Pliny says that glue dissolved in vinegar and then dried, is not again soluble.

What the encaustic painting of the ancients was, has been much disputed. From the works of Vitruvius and Pliny, it appears evidently that it was of three kinds.

*First*, where a picture painted in the common way, was covered with a varnish of wax melted, diluted with a little oil, and laid on warm with a brush.

*Secondly*, where the colours themselves were mixed up with melted wax, and the mixture used while warm. And,

*Thirdly*, where a painting was executed on ivory by means of the *cestrum* or *viriculum*.

Some experiments on this last method by Mr Colebrook may be found in the Phil. Trans. vol. 51. and more particular directions in Muntz's Treatise on Encaustic Painting.

It appears from ancient writings of the best authority, that in the earliest and purest times of this art, the painters used few colours, perhaps not more than four. "The paintings of the ancients (says Dionysius Halicarnasseus) were simple and unvaried in their colouring, but correct in their drawing, and distinguished by their elegance. Those which succeeded, less correct in their drawing, were more finished, more varied in their light and shades, trusting their effect to the multitude of their colours." But no certain conclusion can be drawn, that the more early among the great painters of the ancients, such as Apollodorus, Zeuxis, Timanthes, &c. had no more colours than four to use, merely because they did not use them. On the contrary, it may be conjectured with some degree of probability, from their chasteness in design, and from the complaints Pliny makes of the gaudy taste of the Roman painters, that the Greeks in general were *designedly* chaste in their colouring, and not so merely from necessity, at least about the time of Zeuxis and Apelles; for the former could not have painted grapes so naturally as he is said to have done with four colours only: and the rebuke given by the latter to one of his scholars who had painted an Helen very gaudily, is a confirmation of these observations. "Young man (says Apelles), not being able to make her beautiful, you have made her rich."

10 The colours used by the ancients.

Of white colouring substances, the ancients had white lead variously prepared, a white from calcined egg-shells, and preparations from cretaceous and argillaceous earths. The moderns in addition have magistery

glistery of bismuth, little used; and *ought* to have the calces of tin and zinc.

Of *blacks*, the ancients had preparations similar to lamp, ivory, blue, and Franckfort black; also to Indian ink, and common writing ink; and they used, what we do not, the pricipitate of the black dyers vats.

The ancients possessed a species of *vermilion* or fine cinnabar, a coarser cinnabar, red lead, various earths burnt and unburnt, apparently similar to our red ochre; Venetian red, Indian red, Spanish brown, burnt terra de Sienna, and scarlet ochre; they had also a substance alike in colour and in name to our dragon's blood.

The yellow pigments of the ancients were generically the same with our operiments, king's-yellow, Naples yellow, &c. They did not possess turbeth-mineral, mineral yellow, or gamboge; nor do they appear to have known of gall-stone as a pigment.

Of blue paints they had preparations from the lapis syanus and lapus armenus. Indigo they had, and perhaps bice and smelt; for they made blue glass, but whether from some ore of cobaltor or of wolfram must be uncertain: they had not Prussian blue, verditer, nor litmus which we have. We do not use the blue precipitate of the dyers vats, nor mountain blue, which they certainly employed.

Of green colours they had verdegrise, terra vert, and malashite, or mountain green. The latter is not in use among us. Sap green, green verditer, and Scheele's green, appear to have been unknown to them: like us, they procured as many tints as they pleased from blues and yellow vegetables.

We have no original *purple* in use: that from gold by means of tin, though very good, when well prepared, is too dear perhaps, and unnecessary. Their purple was a tinged earth. Their orange or sandarac (red orpiment) we also possess. Hence there does not appear to have been any great want of pigments, or any very material difference between the colours they used and such as we generally employ. Perhaps the full effect of colouring may be obtained without the use of exceeding brilliant pigments, depending chiefly on the proportion and opposition of tints.

11 Whether the ancients painted in oil.

The ancients could not know any thing about the spirit varnishes, distillation being a modern invention; but they were undoubtedly acquainted with the use of the better oil varnishes, that is, with the use and effect of resinous gums dissolved in boiling inspissated oils.

One of the best preserved mummies in the British museum has an astonishing brightness of colours on the outside of the coffin. Thousands of years have not impaired them; they are as fresh as if they had been laid on yesterday.

The chalk ground, and the excellency of the colours, some of which imply a good deal of chemical and metallurgical knowledge, do not sufficiently account for their splendour and freshness: it must be owing to other circumstances; either to the mixture of shining colours, or to a hard glossy skin, which visibly covers them all over.

From an accurate examination of one of those mummies belonging to the university of Cambridge, it appeared, that the varnish which covered the colours could not be dissolved, or in the least affected by common water; and that it equally resisted the dissolving power of the strongest spirits: hence it is reasonable to conclude that the coffins of the mummies were not covered with size, whites of eggs, simple gums, or any preparation of wax, but with a fine transparent oil varnish. It was discovered at the same time, that the colours themselves were not prepared or mixed with oil; for where the external glossy skin was damaged, broken, or rubbed off, even common water would wash the colours away, and affect the chalk ground under them.

Pliny has described the general and particular effects of the varnish of Apelles, under the name of *atramont*, so distinctly, that nobody can distinguish the thing or the mixture he is speaking of. He has mentioned the shining glossy skin of the varnish which excites the brightness of the colours, and preserves them against dust; he observed, that this skin was laid on so thin, that it could not be discerned at any distance: nor was he less accurate in reporting the particular effects of that mixture which Apelles made use of; it harmonized and lowered the tone of the brightest florid colours in an imperceptible manner, and the whole appeared as if it had been seen through isinglass. The chemists and connoisseurs are fully of opinion, that no liquid substance or mixture of any kind is fit to produce these effects besides the oil varnishes: and if there are not, Apelles and the Greeks were certainly acquainted with those varnishes: a fact which might be strongly urged in behalf of their knowledge of oil colours.

The black outlines of the figures on the most ancient Greek paintings yet extant, that is, on Etruscan vases, are so sharp, so thick, and drawn in so easy and masterly a manner, that one cannot help looking upon them as having been drawn in oil colours. Had they been in distemper or water colours on the red clay ground on which they are applied, they would have been imbibed and soaked into it. Our china and enamel painters prepare and apply their colours with spike or other liquid oils; and the Greek masters seem to have done the same, unless they should appear to have burnt their vases before they painted them, or to have used a mixture of dissolved wax or gum for giving a body to their colours, which might have answered the same end as oils. And this is the more probable, as there is some reason to believe that these vases went through two different fires, that of baking them, and that of smelting or burning in their colours.

The Greek and Roman paintings that have been preserved or discovered at Rome and Herculaneum do not countenance the supposition of oil colours; at least Turnbull and the academists at Naples, who have described the royal collection at Portici, Cochin, and many other authors who have seen and described them, do not hint any thing of that nature. On the other hand, Vitruvius, who has left us so many valuable notices of the ancient arts, acquaints us, that there was a kind of painting which absolutely required a mixture of oil: And Pliny, to the same purpose, expressly says, "Sun and moon shine are inimical and obnoxious to red lead. The remedy is to apply the red wax when hot and melted *with some oil* on the well dried walls which is to be done with brushes."

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From these observations, the evidence which the ancients have given us in behalf of themselves, and of their knowledge of oil painting, may be summed up in few words.

Their having been acquainted with the white chalk ground, which many modern masters have used for oil painting on boards, proves no more than that the ancients might have done the same.

The oil varnishes used by the Egyptians and by Apelles might have brought them to the discovery of oil painting; but as it appears both from mummies and from the works of Pliny, that their colours were not prepared and mixed with that varnish, and as it is plain rather that this varnish was externally laid over the finished pictures; no other conclusion can be drawn, except that they were within sight of the discovery, and that it is a matter of wonder that they should not have laid hold of it.

The outlines of the old Greek or Etruscan vases are merely fallacious appearances.

The old Greek and Roman paintings on walls and stones are either painted in distemper and fresco, or they have not been sufficiently examined.

The oil used in the coarser wax and wall paintings proves at most that experiments had been tried with oils; but we have no direct proofs of oil painting having been understood or used by the Egyptians, Greeks, or Romans; and that, however great their skill or ingenuity, they might very well have been within sight and reach of the discovery, and nevertheless have missed it.

12
Rise, progress, and decline, of modern painting.

The art of painting was revived in Europe about the end of the 13th or beginning of the 14th century. The human mind, however, plunged in profound ignorance, was destitute of every principle of sound philosophy which might enable it to determine on the objects of the arts; and of consequence the painters contented themselves with works adapted to the general taste, without beauty and without proportion. In Italy, where the first attempts were made, they were employed in representing the mysteries of the *passion*, and subjects of a similar nature, on the walls of chapels and churches. Their labours were directed to a vast number of figures, rather than to the beauty and perfection of each; and the art in more modern times has always preserved somewhat of this absurd fault which it contracted at that early period. The artist in our times is not, like those in Greece, at liberty to devote his talents only to men of knowledge and discernment; he is constrained to please those who are rich, and very frequently those who are ignorant. Instead of proposing to himself the perfection of the art as the great object of his pursuit, he must rest his success and character on the facility of his operation and the abundance of his works.

Painting did not long continue in the imperfect condition in which it was left by those who first cultivated it among the moderns. It was natural that their successors should endeavour to surpass them by joining some degree of theory to the barbarous practice they had adopted. The first thing which they discovered, or rather which they revived after the manner of the ancients, was perspective. This made the artists capable of expressing what is called *foreshortening*, and of giving more effect and more truth to their works.

Dominique Ghirlandaio, a Florentine, was the first who enriched the style of his composition by grouping his figures, and who gave depth to his pictures, by distinguishing, by exact gradations, the spaces which his figures occupied; but his successors have far surpassed him in boldness of composition.

Leonard da Vinci, Michael Angelo, Giorgian, Titian, Bartholemew de St Marc, and Raphael, flourished about the end of the 14th century. Leonard da Vinci was the inventor of a great many details in the art: Michael Angelo, by studying the ancients, and by his knowledge of anatomy, arrived at great elegance in drawing the outlines of his figures: Giorgion enriched the art in general, and gave greater brilliancy to his colours than his predecessors: Titian, by a careful imitation of nature, made great proficiency in the truth and perfection of his tones: Bartholemew de St Marc studied particularly the part of drapery, and discovered the claro obscuro, the best manner of giving drapery to his figures, and of making the naked to be felt even where they were covered: Raphael, endowed with a superior genius, began with studying carefully all his predecessors and all his contemporaries. He united in himself all the excellencies which they possessed; and formed a style more perfect and more universal than any painter who went before or who has succeeded him. But while he excelled in every part of the art, he was chiefly superior in those of invention and of composition. It is probable that the Greeks themselves would have been filled with admiration if they had beheld his chief pieces in the Vatican, where to the greatest abundance of paintings is joined so much perfection, and purity, and ease

After painting had arrived at the greatest perfection among the Greeks by the exertions of Zeuxis and Parrhasius, Apelles found nothing to add to the art except grace; in the same manner among the moderns, after Raphael had appeared, grace was the only thing wanting to the art, and Corregio became the Apelles of Europe. Painting was by him carried to the highest degree among the moderns; the taste of the best critics and the eye of the vulgar were equally gratified.

After these great masters a considerable interval elapsed till the time of the Caracci. Those artists, born at Bologna, by studying the works of their predecessors with great care, and particularly those of Corregio, became the first and the most celebrated of their imitators. Hannibal possessed a very correct design, and united somewhat of the ancient style to that of Lewis his brother; but he neglected to inquire into the intricate principles and philosophy of the art. The pupils of the Caracci formed a school after their manner; but Guido, a painter of an easy and happy talent, formed a style altogether graceful, and rich, and easy. Guerchen formed after Caravaggio, or invented himself a particular style of the claro-obscuro, composed of strong shades and vivid oppositions.

Peter de Cortone succeeded those great imitators of their predecessors and of nature; who finding it difficult to succeed in that kind of painting, and having besides great natural abilities, applied himself chiefly to composition or arrangement, and to what the artists call taste. He distinguished invention from composition; appeared not to have attended to the former,

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but chiefly to those parts which are most prominent in the picture, and to the contrasting of groups. It was then that the practice was introduced of loading pictures with a great number of figures, without examining whether or not they agreed to the subject of the history. The ancient Greeks employed a very small number of figures in their works, in order to make the perfection of those which they admitted more evident. The disciples or imitators of Cortona, on the other hand, have sought to conceal their imperfections by multiplying their figures. This school of Cortona is divided into many branches, and has changed the character of the art. The multiplication of figures, without a judicious and proper choice, carried back the art of painting to that point where the first restorers of it among the moderns had left it; while at the same time the disciples of Cortona were enabled to give to this first condition of the art a greater degree of perfection than the first artists.

About the middle of the 17th century flourished at Rome Carlo Maratti, who, aiming at the greatest perfection, carefully studied the works of the first painters, and particularly those of the school of the Caracci. Although he had already studied nature, he discovered by the works of these artists that it is not always proper to imitate her with a scrupulous exactness. This principle, which he extended to every part of the art, gave to his school a certain style of carefulness, which however is considerably degenerated.

France has also produced great masters, particularly in the part of composition; in which Poussin, after Raphael, is the best imitator of the style of the ancient Greeks. Charles le Brun and many others distinguished themselves for great fertility of genius: and as long as the French school departed not from the principles of the Italian school, it produced masters of great merit in the different branches of the art.

Mengs, from whom this account is taken, is not deceived when he declares the art of painting to have degenerated in France after Le Brun; but he seems to be mistaken in giving the imitation of the works of Rubens found at Paris as the cause of this decay. It appears from this opinion, that the recent French school was not well known to him. The French, indeed, if we may believe their own authors, were never much occupied in the imitation of Rubens; and they have for a long time despised him. But the perfection of the dramatic art in France, the dress of their actors, the magnificence and manners of the court, have contributed very much to the decay of painting. Instead of forming their taste on the beautiful simplicity of nature, their painters studied the gestures and the attitudes of comedians, the fopperies of women of fashion, the affected airs of courtiers, the pageantry of Versailles, and the magnificence of the opera. Mengs says, "that the French have formed a national style, of which ingenuity and what they call *esprit* are the discriminating qualities; that they have ceased to introduce Greek, Egyptian, Roman, or barbarian personages into their paintings; and that, after the example of Poussin, they content themselves with figures altogether French, as if it were their intention to hand down to posterity that such a nation once existed."

Since, according to the confession of Mengs, their figures are altogether French, there is no reason to believe that the French painters have imitated Rubens, whose works are marked much more strongly than those of his master Æneus with the Flemish character. The truth is, that their painters, like Cortona and Maratti, have crowded their pictures with a great number of figures; have grouped them in a manner most calculated to strike the senses; have been more intent on agreeable artifices than expression and beauty; and, finally, that they have borrowed the manners of the court and theatre.

The first masters of the great schools of painting, with the ancients and nature for their guides, and their genius for their support, carried every part of the art to the greatest height of perfection. Those who followed them, and who had the example of their predecessors in addition to the first sources of truth and beauty, did by no means arrive at the same excellence. The Caraccis in their school, Paul Veronese, and all the painters of his time, Vandyke, and all those who exercised the art in Italy, in Flanders, and in France, supported it with great brilliancy. But soon after the number of artists was multiplied; and slavishly copying men of inferior talents, they produced works of an inferior nature. Some wanting to be colourists, their pieces were exaggerated; others affecting simplicity, became cold and insipid. At this period of the art, men of real abilities, and covetous of fame, who wished to rise superior to the mediocrity of the times, seem not to have taken the road of truth and nature. They affected a style of pompous preparation, and annexed a kind of merit to the expert management of the pencil. The affected forms of Cortona and of his pupils, the fantastical attitudes and the poignant effects of Piazetta, and in short the ingenious contrivances of the last masters of the French school, are decided proofs of this increasing bad taste.

It appears, that for some time past greater pains has been taken to form men for the art than to encourage those who possess the talent. In consequence of this ruinous practice, schools for drawing, very different from those formed by able painters, have been exceedingly multiplied; and these give the elements according to an uniform system, by which the mind is laid under a regular restraint at the very threshold of the profession. This evil is productive of two inconveniences; it gives middling painters, and it multiplies them to that degree, as to hasten the downfal and bring into contempt the art itself.

The particular reputation of the Italian painters furnishes another reason for the decline of the art. The first painters of that country were few in number; they were honoured, and they deserved to be honoured. Their distinguished reputation has conferred a value on the general paintings of their countrymen. The desire of possessing taste, or of being thought to possess it, has led the rich and the ignorant of all nations to give a preference to the Italian market. Necessity, in this case, would multiply the painters; and their abilities must bear a pretty exact proportion to the discrimination of those who give the price.

The decline of painting has also arisen from the despotism which for some time reigned in the academic societies. In fact, these have often been ruled by men

men who would force every exertion of genius into their peculiar tract of operation. If they required such or such merit of execution, the first principles of the art were neglected for that peculiar excellency. In this manner the schools were absolute in behalf of design as long as statuary was held in chief estimation. The artist, whose abilities and inclination led him to colouring, was obliged to abandon a pursuit which could be of no service to him, and devote himself to that for which he was not qualified by nature. On the other hand, if the instructions of the schools be confined to colouring, a mind disposed to the choice and exactness of forms will find no encouragement, and be for ever lost to the art. In this manner the ignorance of those who wish to be connoisseurs, and the narrow views of those who pretend to direct the general taste, have equally contributed to the decline of the arts.

## Sect. II. *Of the Schools.*

A School, in the fine arts, denominates a class of artists who have learned their art from a certain master, either by receiving his instructions, or by studying his works; and who of consequence discover more or less of his manner, from the desire of imitation, or from the habit of adopting his principles.

All the painters which Europe has produced since the renovation of the arts are classed under the following schools: the school of Florence, the school of Rome, the school of Venice, the Lombard school, the French school, the German school, the Flemish school, the Dutch school, and the English school.

13 School of Florence. This school is remarkable for greatness; for attitudes seemingly in motion; for a certain dark severity; for an expression of strength, by which grace perhaps is excluded; and for a character of design approaching to the gigantic. The productions of this school may be considered as overcharged; but it cannot be denied that they possess an ideal majesty, which elevates human nature above mortality. The Tuscan artists, satisfied with commanding the admiration, seem to have considered the art of pleasing as beneath their notice.

This school has an indisputable title to the veneration of all the lovers of the arts, as the first in Italy which cultivated them.

Painting, which had languished from the destruction of the Roman empire, was revived by Cimabue, born of a noble family in Florence in the year 1240. This painter translated the poor remains of the art from a Greek artist or two into his own country. His works, as may easily be imagined, were in a very ordinary style, but they received the applause and admiration of his fellow-citizens; and if Cimabue had not found admirers, Florence in all probability would not have been honoured with Michael Angelo. The number of painters became soon so considerable in Florence, that in the year 1350 they established a society under the protection of St Luke.

Massolino, towards the beginning of the 15th century, gave more grandeur to his figures, adjusted their dress better, and shed over them a kind of life and expression. He was surpassed by Massacio his pupil; who first gave force, animation, and relievo to his works.

Andrew Castagna was the first Florentine who painted in oil. But Leonardo da Vinci and Michael Angelo, contemporary painters, were the glory of the school of Florence. Michael Angelo was superior to Leonardo in grandeur, in boldness of conception, and in knowledge of design; but Leonardo was superior to him in all the amiable parts of the art. Leonardo, possessed of a fine imagination, and full of sensibility, devoted himself in painting to express the affections of the soul; and if, in this sublime branch of the art, he was afterwards surpassed by Raphael, he had at least the glory not only of exceeding all the painters who went before him, but of pursuing a path which none of them had attempted. His design was pure and neat, and not wholly destitute of greatness. He never went beyond nature, and he made a good choice of objects for imitation.

Michael Angelo, less formed to experience sweet affections than vehement passions, sought in nature what the strength of man might accomplish, not that which constitutes beauty. He delighted in being great and terrible, more than in graceful and pleasant attitudes. Well acquainted with anatomy, he knew more exactly than any other artist in what manner to express the joining of the bones of the body, and the office and insertion of the muscles; but too eager to display his knowledge of anatomy, he seems to have forgotten that the muscles are softened by the skin which covers them; and that they are less visible in children, in women, and in young men, than in confirmed and vigorous manhood. "In his figures (says Mengs) the articulations of the muscles are so easy and free, that they appear to be made for the attitude in which he represents them. The fleshy parts are too much rounded, and the muscles are in general too large, and of too equal strength. You never perceive in his figures a muscle at rest; and although he knew admirably well how to place them, their action is very frequently inconsistent with their situation."

"He did not possess (says Sir Joshua Reynolds) so many delightful parts of the art as Raphael; but those which he had acquired were of a more sublime nature. He saw in painting little more than what might be attained in sculpture; and he confined it to exactness of form and the expression of passions."

He informs us, in one of his letters, that he modelled in earth or wax all the figures which he intended to paint. This method was familiar to the great painters of his time, and ought never to be abandoned. It appears, that in representing them in this manner in relievo, the painter can imitate them much more exactly than when they are drawn with a crayon or pencil on a plain surface.

"Michael Angelo (continues Sir Joshua Reynolds) never attempted the lesser elegancies and graces in the art. Vasari says, he never painted but one picture in oil; and resolved never to paint another, saying it was an employment only fit for women and children.

"If any man had a right to look down upon the lower accomplishments as beneath his attention, it was certainly Michael Angelo; nor can it be thought strange, that such a mind should have slighted, or have been with-held from paying due attention to all those graces and embellishments of art which have diffused such lustre over the works of other painters."

14 Roman School.

Ancient Rome, rich with the works brought from Greece, or finished in its own bosom by Grecian artists, handed down in its ruins the remains of that glory to which it had been elevated. It was by the study of these remains that the modern artists were formed: they derived from them the knowledge of design, the beauty of exquisite forms, greatness of style, and justness of expression, carried to that length only which did not affect the beauty of the figure. From them also they derived the principles of the art of drapery; and they followed these principles even while they made the drapery of modern paintings more large and flowing than what was practised by the ancient sculptors. The Roman school was altogether devoted to the principal parts of the art, to those which require genius and vast conceptions; and was no farther occupied with colours than what was necessary to establish a difference between painting and sculpture, or rather between painting varied with colours and in claro-obscuro.

Raphael Sanzio, born at Urbino in 1483, and scholar to Pietro Perugeno, was the undoubted founder of this school. His first manner was that of Perugeno his master; but he travelled twice to Florence to study the great artists who flourished in that city.

It was fortunate for Raphael, says Mengs, that he was born, in what he terms the infancy of the art, and that he formed himself by copying nature before he had access to see the works of any great master. He began by studying, with great exactness, the simple truth in his figures. He was then ignorant that any choice was necessary; but he saw the works of Leonardo da Vinci, of Massacio, and of Michael Angelo, which gave his genius a new direction. After this he perceived that there was something more in the art of painting than a simple imitation of truth. But the works of those masters were not sufficiently perfect to point out the best choice to make; and he continued in uncertainty till he saw at Rome the works of the ancients. Then he perceived that he had found the true models which he wanted; and in imitating them he had only to follow the natural impulse of his genius.

Habituated by his first manner to imitate nature with precision, it was not difficult to carry the same exactness into the imitation of the ancients; and it was a great advantage to him that he flourished in an age wherein the artists were not arrived at facility of execution at the expence of rigorous exactness. He never lost sight of nature; but he was instructed by the ancients in what manner she should be studied. He perceived, that the Greeks had not entered into minute details, that they had selected what was great or beautiful, and that one of the chief causes of the beauty of their works was the regularity of their proportions: he began, therefore, by carefully studying this part of the art. He saw also that the joinings of the bones, and the free play of their articulations, are the causes of all graceful movement: he therefore, after the example of the ancients, gave the greatest attention to this part, and was led by these observations not to be contented with the simple imitation of nature.

His design is excellent, but neither so perfect nor so finished as that of the Greeks. He excelled in representing the character of philosophers, apostles, and othe figures of that kind; but he did not equal the Greeks in ideal figures, which ought to carry the impression of divinity. His taste for design was more Roman than Greek, because he formed it chiefly on the basso-relievos which he found at Rome. On this account he had the habit of marking strongly the bones and the articulations, and labouring the fleshy parts less; but as these basso-relievos are very exact with regard to the reciprocal proportions of every member, he excelled in this part, while at the same time he did not give to his figures all the elegance of the Greek artists, nor the flexibility of articulation which is admired in the Laocoon, in the Apollo of Belvidere, and in the Gladiator.

The manners and spirit of his age, and the subjects which he most commonly treated, prevented him from reaching the ideal of the ancients. Having seldom occasion to represent figures altogether ideal, he devoted himself to purity of expression. He knew that the expression of the passions of the soul is absolutely necessary in an art which represents the actions of men, since from those affections the actions may be said truly to originate. To make figures act, and yet neglect the interior springs of action, is nothing more than a representation of automata. The attitudes and action are evident; but they appear not to act of themselves, because they are void of those principles from which alone men are supposed to act. An artist who neglects expression, gives no just representation of character, even though he should take nature for his model.

Raphael's first care, when he wanted to compose a piece, was to weigh the expression; that is to say, to establish, according to the nature of the subject, the passions which were to animate the characters. All the figures, all the accessories, all the parts of the composition, were moulded to the general expression.

As he had not found examples in the ancient statues of the claro-obscuro, he was comparatively weak in this part; and if there was any thing remarkable in his distribution of light and shade, he owed it to the works of the Florentine painters. It cannot be said, however, even with regard to the claro-obscuro, that he imitated nature without taste. He delighted in what are called *masses* of light; and disposed the great lights in the most conspicuous places of his figures, whether naked or in drapery. If this method did not produce effects highly illusive, it gives his works that distinctness which makes his figures conspicuous at a distance; and this must be allowed to be an essential part of the art of painting. He did not proceed beyond this; and content with that kind of claro-obscuro which comprehends imitation, he never attempted that which is ideal.

The composition and the *ensemble* of his figures were the chief excellencies of Raphael. His philosophical mind could not be affected with objects which had not expression. He had too high an idea of painting to consider it as a mute art; he made it speak to the heart and soul: and he could only do this in subjects which required expression. If Raphael did not reach the Greek excellence, if he did not possess the art of embellishing nature in the same high degree, he saw at least, and imitated her in whatever was expressive and beau-

beautiful. "The Greeks sailed with majesty (says Mengs) between earth and heaven: Raphael walked with propriety on the earth."

"Composition is in general (says the same author) of two kinds: Raphael's is the expressive kind; the other is the theatrical or picturesque, which consists of an agreeable disposition of the figures. Lanfranc was the inventor of this last, and after him Pietro de Cortona. I give the preference to Raphael; because reason presides over all his works, or at least the greatest part of them. He never allowed himself in common ideas, and was never allured to give any thing in his accessory figures which might turn the attention from the principal object of the piece."

A history of the schools is nothing more than a history of the painters who founded them. In those two which we have already given, Michael Angelo and Raphael come readily forward to claim our attention; and therefore we cannot do better than conclude the account by the masterly contrast of these eminent painters given by Sir Joshua Reynolds. "If we put those great artists (says he) in a light of comparison with each other, Raphael had more taste and fancy, Michael Angelo more genius and imagination. The one excelled in beauty, the other in energy. Michael Angelo has more of the poetical in operation; his ideas are vast and sublime; his people are a superior order of beings; there is nothing about them, nothing in the air of their actions, or their attitudes, or the style and cast of their limbs or features, that puts one in mind of their belonging to our species. Raphael's imagination is not so elevated; his figures are not so much disjointed from our own diminutive race of beings, though his ideas are chaste, noble, and of great conformity to their subjects. Michael Angelo's works have a strong, peculiar, and marked character; they seem to proceed from his own mind entirely; and that mind so rich and abundant, that he never needed, or seemed to disdain, to look abroad for foreign help. Raphael's materials are generally borrowed, though the noble structure is his own. The excellency of this extraordinary man lay in the propriety, beauty, and majesty of his characters; his judicious contrivance of composition, correctness of drawing, purity of taste, and the skilful accommodation of other mens conceptions to his own purpose."

15 Venetian school.

This school is the child of nature. The Venetian painters not having under their eyes like the Roman the remains of antiquity, were destitute of the means of forming a just idea of the beauty of forms and of expression. They copied without choice the forms of nature; but they were chiefly delighted with the beauties which presented themselves in the mixture and the variety of natural colours. Their attention not being detached from this part by any thing of greater importance, colouring was their chief object, and they succeeded in it. They did not rest contented with characterizing the objects by comparison, in making the colour proper for one of more value by the colour more proper for another; but they endeavoured still farther, by the agreement and opposition of the coloured objects, and by the contrast of light and shade, to produce a vigorous effect, to demand and fix the attention. Dominic, who was said to have perished at Florence by the jealousy of André Castagna, and who was the second Italian artist who painted in oil, had educated, before he quitted Venice, his native country, Jacques Bellin, who was remarkable for nothing but the picturesque education which he gave to Gentel and John his two sons.

Gentel, who was the eldest, painted chiefly in water colours. John contributed much to the progress of his art in painting constantly in oil, and after nature. Although he always retained great stiffness in his manner, he had less than his father or brother. Great neatness of colouring, and an approach to harmony, are evident in his works. His taste in design is Gothic, the air of his heads is sufficiently noble, his attitudes are without judgment, and his figures without expression. He had for scholars Giorgion and Titian, who deserve to be considered as the founders of the Venetian school.

Giorgion distinguished himself by a design of a better taste than that of his master; but he chiefly surpassed him in colouring. He died in his 32d year; and excited the emulation of Titian, who soon greatly excelled him.

Tiziano Vecelli, known best by the name of *Titian*, was instructed to copy nature in the most servile manner in the school of John Bellin; but when he had seen the works of Giorgion, he began to study the ideal in colouring.

The truth of history is not to be expected in his historical paintings, or in those of the artists of the same school. He seems to have paid little attention to the consistency of scene, to the costume, to expression adapted to the subject, or, finally, to the accommodation of parts which characterise the works of those who have studied the ancients. He was in short a great painter and nothing more.

But although he deserves not to be placed among the most distinguished artists in point of judgment, yet he is by no means destitute of great and noble conceptions. There is often to be found among his male figures a considerable degree of grandeur: but if he has sometimes, like Michael Angelo, overcharged his design, it was more discovered in the swelling of the soft and fleshy parts than in rigour and muscular strength.

Almost entirely devoted to simple imitation, he had scarcely greater choice in the claro-obscuro than in design. He cannot be justly reproached at the same time for weakness in this particular; because in endeavouring to imitate the colours of nature, he was obliged to observe the degrees of light. And in proportion as he succeeded in the imitation of natural colours he must be less defective in the claro obscuro; but it is not in the knowledge of this part of the art that we are to seek for the beauties of his works. These are to be found in the happy dispositions of colours both proper and local, and he carries this to the highest point of perfection.

The artists in the Florentine and Roman schools painted most commonly in water colours or in fresco; and in the exercise of their profession, instead of nature, they finished their works from their first sketches. Titian painted in oil, and finished from the objects in nature; and this practice, joined to his exquisite talents, gave the greatest truth to his colours. His being a portrait painter was also of advantage to him as a

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a colourist. In this department he was accustomed to the colours of nature in carnations and draperies. He was a landscape-painter, and here also he took the colours from nature.

"As Titian perceived (says Mengs) that the objects which are beautiful in nature have often a bad effect in painting, he found it necessary to make a choice in the objects of imitation; and he observed, that these were objects of which the local colours were extremely beautiful, which nevertheless were in a great measure destroyed by the reflection of light, by the porosity of the body, and by different luminous tints, &c. He perceived also, that in every object there was an infinite number of half tints, which conducted to the knowledge of harmony. In short, he observed in the objects of nature, a particular agreement of transparency, of opacity, of rudeness, and of polish, and that all objects differed in the degrees of their tints and their shades. It was in this diversity he sought the perfection of his art; and in the execution he moderated the effect of natural colours. For example, in a carnation which had many demi-tints, he confined himself to one; and he employed even less than a demi-tint, where there were few in the natural object. By this means he obtained a colouring exquisitely fine; and in this part he was a great master, and deserves to be carefully studied."

Titian has in general little expression in his pictures, and he sometimes introduces figures which augment the coldness of the piece; for if it be true that the heads, even in historical painting, ought to be studied after nature, it is true also that an individual nature ought not to be presented, but one general and ideal. It is necessary that they should be men, while they resemble not men we are accustomed to see. The painter fails in the effect which he ought to produce, if, when he represents Achilles, Hector, and Cæsar, his personages are familiar to our observation.

The colours of his paintings are so mingled together, as to give no idea of the colours on his pallet; which distinguishes him from Rubens, who placed his colours one at the side of another. It is impossible to say, on the narrowest inspection, with what colours he produced his tints. This practice, which enabled him to imitate so exactly the colours of nature, gives a marked distinction to his manner of painting. In the examination of his works, the critics lose an ordinary source of pleasure which arises from marking the freedom of hand; but they may console themselves with the natural and exquisite touches of this artist.

He is of historical painters one of those who have succeeded in landscape. His situations are well chosen; his trees are varied in their forms, and their foliage well conceived. He had a custom of representing some remarkable appearance in his landscapes to render them more striking.

16 Lombard school.

The distinguishing characteristics of this school are, grace, an agreeable taste for design, without great correction, a mellowness of pencil, and a beautiful mixture of colours.

Antonio Allegri, called *Corregio*, was the father and greatest ornament of this school. He began like the painters of his time to imitate nature alone; but, as he was chiefly delighted with the graceful, he was careful to purify his design from all short turnings and unnecessary angles. He perceived that largeness contributed to grace; and therefore he not only rejected all small figures, but enlarged as much as possible the outlines, avoided acute angles and straight lines, and by these means gave an easy grandeur to his design. He made his figures elegant and large; he varied the outlines by frequent undulations; but he was not always pure and correct.

Corregio painted in oil, a kind of painting susceptible of the greatest delicacy and sweetness; and as his character led him to cultivate the agreeable, he gave a pleasing captivating tone to all his pictures. He sought transparent colours to represent shades conformable to nature, and adopted a manner of glazing which actually rendered his shadows more obscure. Obscurity in painting cannot be fully obtained without transparent colours; for these absorb the rays of light, and of consequence give less reflection. He laid his colours very thick on the brightest parts of his pictures, to make them capable of receiving, by a proper touch, the greatest degree of light. He perceived, that the reflections of light correspond with the colour of the body from which they are reflected; and on these principles he founded his theory of colours with respect to light and shade and reflection. But it is chiefly in the colour of his shades that he deserves to be imitated; for his lights are too clear, and somewhat heavy; and his fleshy parts are not sufficiently transparent.

Harmony and grace are connected together; and on this account Corregio excelled also in harmony. As the delicacy of his taste suffered him not to employ strong oppositions, he naturally became a great master in this part, which chiefly consists of easy gradations from one extreme to another. He was harmonious in his design, by making the lines which formed the angles of the contour arched and undulated. But in the lights and shades, he placed always between the two extremes a space which served to unite them, and to form a passage from the one to the other. The delicacy of his organs made him perceive, better than any other artist, what relief was necessary to the eye after a violent exertion; and he was therefore careful to follow a bold and prevailing colour with a demi-tint, and to conduct the eye of the spectator, by an invisible gradation, to its ordinary state of tension. In the same manner (says Mengs) does agreeable and melting music pull one so gently out of sleep, that the awaking resembles inchantment more than the disturbing of repose. A delicate taste in colours, a perfect knowledge of the claro obscuro, the art of uniting light to light, and shade to shade, together with that of detaching the objects from the ground, inimitable, grave, and perfect harmony, were the qualities which distinguished Corregio from all the painters, and placed him near the head of his profession.

The Carracci, Lewis, Augustin, and Hannibal, formed what is called the *second Lombard school*, which is frequently distinguished by the name of the *school of Bologna*.

Lewis was the master of the other two; he had studied the works of Titian and Paul Veronese at Venice, those of André del Sarte at Florence, those of Corregio at Parma, and those of Jules Romaen at Mantua,

Mantua; but he chiefly endeavoured to imitate the manner of Corregio. Hannibal fluctuated between Corregio and Titian. Augustin their rival in painting had his mind cultivated by learning, and devoted part of his time to poetry and music, to dancing and to other manly exercises. These three painters often employed their talents on the same piece; and it was admirable that their united labours seemed to be animated with the same spirit.

They established an academy at Bologna, which their zeal for the advancement of their art made them call *l'Academia degli Desiderosi*; but it was afterward called the *Academy of the Caracci*, because the reputation which these artists acquired, permitted not a more illustrious name to be given to an establishment of which they were the founders. In this school were taught the art of constructing models, perspective, and anatomy; lessons were given on the beautiful proportions of nature, on the best manner of using colours, and on the principles of light and shade. They held frequent conferences, in which not only artists, but men of general knowledge, were permitted to elucidate points relative to the art of painting: but they were separated upon Hannibal's going to Rome to adorn the gallery of the cardinal Farnese.

The works of the Caracci are often, from the resemblance of their manner, confounded together; especially those which were finished previous to the residence of Hannibal at Rome. Meanwhile each of them has a decided character distinct from the other two. Lewis had less fire, but more of gracefulness and grandeur; Augustin had more spirit in his conception, and more pleasantness in his execution: Hannibal is characterized by boldness, by a design more profound, by an expression more lucky, and by an execution more solid.

Sir Joshua Reynolds, who saw the works of Lewis at Bologna, holds him out in his discourses as the best model for what is called *style* in painting; which is the faculty of disposing colours in such a manner as to express our sentiments and ideas. "Lodovico Caracci," says he, "(I mean in his best works) appears to me to approach the nearest to perfection. His unaffected breadth of light and shadow, the simplicity of colouring, which, holding its proper rank, does not draw aside the least part of the attention from the subject, and the solemn effect of that twilight which seems diffused over his pictures, appears to me to correspond with grave and dignified subjects better than the more artificial brilliancy of sunshine which enlightens the pictures of Titian."

Hannibal is esteemed by the best judges as a model for beauty and design. Those who blame him for becoming less a colourist at Rome than he was at Bologna, ought to recollect that it is his performances at Rome which have chiefly secured his reputation. Severe critics have maintained that his design is too little varied in his figures; that he excels only in male beauty; that in imitating ancient statues, he excites some resemblance, but without arriving at the sublimity of ideas and of style which characterize the ancients; or, in other words, that he hath successfully imitated the exterior of their manner, but that he was incapable of reaching the interior and profound reasonings which determined those admirable artists.

The success of Hannibal, and the reputation which he acquired, have been pernicious to the art. His successors, deluded by these considerations, have made him the object of their imitation, without ascending to the sources from which he derived his knowledge, and which he never could equal. The result has been, that, instead of becoming equal to Hannibal, they have often copied his imperfections.

17 The French Schools.

This school has been so different under different masters, that it is difficult to characterize it. Some of its artists have been formed on the Florentine and Lombard manner, others on the Roman, others on the Venetian, and a few of them have distinguished themselves by a manner which may be called their own. In speaking in general terms of this school, it appears to have no peculiar character; and it can only be distinguished by its aptitude to imitate easily any impression; and it may be added, speaking still in general terms, that it unites, in a moderate degree, the different parts of the art, without excelling in any one of them.

It is equally difficult to determine the progress of painting in France. Miniature painting, and painting on glass, were early cultivated in that country; and in these two kinds, the Italians had often recourse to the French artists. When Francis I. encouraged Rosso a Florentine, and Primatice a Bolognian, the painters in France were not remarkable for any superior talent; but they were capable of working under these foreign artists.

Cousin, a painter on glass, and portrait-painter, was the first who established any kind of reputation in France. He was correct, but possessed very little elegance of design.

Painting, for some time encouraged by Francis I. fell into a state of languor, from which it was not recovered till the reign of Louis XIII. Jacques Blanchard, formed at the Venetian school, and called *the French Titian*, flourished about this period. But as he died young, and without educating any pupils to perpetuate his manner, he must be regarded as a single good artist, and not as a founder of the French school.

In the same manner Poussin, one of the greatest French painters, and whom they call *the Raphael of France*, educated no pupils, nor formed any school. His style and character of painting are described by Sir Joshua Reynolds as simple, careful, pure, and correct. No works of any modern (adds the same author) have so much of the air of antique painting as those of Poussin. His best performances have a remarkable dryness of manner, which, though by no means to be recommended for imitation, yet seems perfectly correspondent to that ancient simplicity which distinguishes his style.

In the latter part of his life he changed from this manner to one much softer and richer; where there is a greater union between the figures and the ground. His favourite subjects were ancient fables; and no painter was ever better qualified to paint such subjects, not only from his being eminently skilled in the knowledge of the ceremonies, customs, and habits of the ancients, but from his being so well acquainted with the different characters which those who invented them gave their allegorical figures.

If Poussin, in the imitation of the ancients, represents Apollo driving his chariot out of the sea by way of

of representing the sun rising, if he personifies lakes and rivers, it is no way offensive in him, but seems perfectly of a piece with the general air of the picture. On the contrary, if the figures which people his pictures had a modern air or countenance, if they appeared like our countrymen, if the draperies were like cloth or silk of our manufacture, if the landscape had the appearance of a modern view, how ridiculous would Apollo appear? instead of the sun, an old man; or a nymph with an urn, instead of a river or a lake.

Poussin, however, more admired than imitated, had no manner of influence in forming the French school. Simon Vouet, his enemy and persecutor, had this honour, because his pupils, in the happy age of the arts in France, conferred on it the highest splendor. Vouet was a man of distinguished abilities; but the school which he erected would have had no continuance if his scholars had pursued his manner of painting. He had a kind of grandeur and facility; but his design was false with regard to colours, and without any idea of expression. It was said of him, that he only needed to take the pencil in his hand to finish with one stroke the subject which he had conceived; and on this account one is tempted to be pleased, because he is astonished. He had the merit of destroying the insipid manner which reigned in France, and of pointing the way to a better taste.

If Vouet laid the foundation of the French school, Le Brun finished the edifice. When Le Brun was placed under the tuition of Vouet, he astonished his master and the rest of his pupils with the rapidity of his progress. At the age of 26 he finished his piece called the *horses of Diomede*, which gained a place in the palace royal (A), beside those of the most eminent painters. He was afterwards recommended to Poussin; but the young artist was more disposed by his natural inclinations to that modern part of the art which is called the *great machine*, than to the profound and studied manner of the Greek artists. Poussin at the same time was of great service to him, in recommending to his study the monuments, the customs, the dress of the ancients; their architecture, their rites, their spectacles, their exercises, their combats, and their triumphs.

Le Brun had a noble conception and a fruitful imagination. He was on no occasion inferior to the vast compositions which he undertook, and he chiefly excelled in rigorous costume and exact likenesses.

Few painters have united so great a number of essential qualities and accessories of the art; and if he had superiors, it consisted in this, that they possessed some particular quality in a more eminent degree.—He was a good drawer, but his design was far from being so elegant as that of Raphael, or so pure as that of Domenique, and it was less lively than that of Hannibal Carracci, whom he had taken for a model. In drapery he followed the Roman school: the clothes which he gave to his figures were not like those of the Venetian school, of such and such a stuff; they were draperies and nothing more, and this manner agreed with the heroic style of his works; but in this part he was not equal to the painter of Urbino.—He had studied the expression of the affections of the soul, as is evident from his treatise on the character of the passions: but after observing the general characters, and establishing the principal strokes of expression, he thought he reached the whole extent of this subject, which is so infinitely extended. He always employed the few characters which he had once found out, and neglected to study the prodigious variety of gradations by which the interior affections are manifested in the exterior appearance. He fell then into the manner of repeating always; and possessed neither the delicacy, nor the depth, nor the extreme justness, of Raphael's expression. He loved and possessed in a high degree the grand machine of the art; he was delighted with great compositions; and he gave them life, and animation, and variety; but he wanted the vigour and inspiration of Raphael. His compositions are formed on philosophical principles, but those of Raphael are created. Le Brun thought well; Raphael, Poussin, le Sueur, thought most profoundly.—Le Brun had elevation, but he was not elevated like Raphael, to the sublime.

In colouring, Le Brun did not imitate the painters of the Venetian school. The sweet attractions and strong and solid colours of the schools of Rome and Lombardy seem rather to have been the object of his imitation; and from them also he learned an easy, agreeable, and bold management of the pencil.

As Le Brun possessed a great share of lively imagination, he delighted in allegory, which gives the greatest scope for ingenious invention. The fecundity and resources of his imagination appeared still farther, in his inventing symbols for his allegorical figures, without resting contented with those employed by the ancients. But fanciful representations of this kind are distant from the operations of true genius. Spirit and thought in the arts are very different from spirit and thought in literary productions. A painter of moderate abilities may introduce into his works a great deal of the invention which belongs to poetry without enriching his peculiar art. The true spirit of painting consists in making the figures appear in the very circumstances and attitudes in which they are supposed to act, and penetrated with the sentiments with which they ought to be affected. By these means the spectator is more certainly interested than if the actions and thoughts were represented by allegorical symbols. Poussin appears to have less waste of spirit and imagination than Le Brun, while at the same time he gives more delight to people of spirit and imagination.

Eustach le Sueur was the contemporary and rival of Le Brun; and no painter approached nearer to Raphael in the art of drapery, and in disposing the folds in the most artful and the noblest manner. His design was in general more slender than that of Raphael, but, like his, it was formed on the model of the ancients. Like Raphael he represented with art and precision the affections of the soul; like him, he varied the air of the head, according to the condition, the age, and the character of his personages; and, like him, he made the different parts of every figure contribute to the general effect. His intention in composing was to express his subject, not to make shining contrasts

(A) Where it may now be is uncertain. Perhaps it has perished in the wreck of taste, art, science, and elegance, against which French democracy has waged a ruinous war.

Schools.

contrasts or beautiful groups of figures, not to astonish and bewitch the spectator by the deceitful pomp of a theatrical scene, or the splendor of the great machine. His tones are delicate, his tints harmonious, and his colours, though not so attractive as those of the schools of Venice and Flanders, are yet engaging. They steal peaceably on the soul, and fix it without distraction on the parts of the art, superior to that of colouring.

His preaching of St Paul, and the picture which he painted at St Gervais, which the critics compare with the best productions of the Roman School, and the 22 pictures which he painted for the Carthusian monastery at Paris, and which were lately in possession of the king, are esteemed his best pieces. His contemporaries affirm, that he considered as sketches merely those excellent performances which are the glory of the French school.

If Le Sueur had lived longer, or if, like Le Brun, he had been employed under a court, fond of the arts, and of learning, to execute the great works of the age, the French school would have adopted a different and a better manner. The noble beauty of his heads, the simple majesty of his draperies, the lightness of his design, the propriety of his expression and attitudes, and the simplicity of his general disposition, would have formed the character of this school. The deceitful pomp of theatrical decoration would have been more lately introduced, or perhaps would never have appeared, and Paris might have been the counterpart to Rome. But as Le Brun, by an accidental concurrence of favourable circumstances, was the fashionable painter, to be employed or rewarded it was necessary to imitate his manner; and as his imitators possessed not his genius, his faults became not only current but more deformed.

The French School not long ago changed its principles; and if, when peace shall be restored to this unhappy nation, they continue to follow the road which, while the arts flourished among them, they marked out for themselves, they have the chance of becoming the most rigid observers of the laws imposed on the Greek artists. The Count de Ceyles, pupil of Bouchardion, who by his rank and fortune had the means of encouraging the imitators of the ancients, and of the masters of the 15th century, first formed the design of restoring a pure taste to the art of painting. He was seconded by the talents of M. Vien, an artist who had only occasion to have his lessons and his example laid before him.—In this manner commenced a revolution, so much the more wonderful, as it was scarcely ever known that any nation substituted a system of simple and rigid excellence in place of a false and glittering taste. The history of all nations, on the contrary, discovers a gradual progress from a rude beginning to perfection, and afterwards to irremediable decay. The French had the prospect of stopping short in this ordinary course. They began in a manner which promised success; and the best consequences may be expected, if the internal commotions of France do not destroy the taste for the arts, the exercise of which they have suspended.

18 The German school.

In Germany there can hardly be said to be a school, as it is a continuation of single artists, who derived their manner from different sources of originality and imitation. There were some German painters of eminence, when the art, emerging from its barbarous state, first began to be cultivated with success in Europe. As they were totally unacquainted with the ancients, and had scarcely access to the works of their contemporaries in Italy, they copied nature alone, with the exception of somewhat of that stiffness which forms the Gothic manner. It is this manner, if we speak of the early German painters, which characterizes their school. But this is by no means the case with their successors, part of whom were educated in Flanders and part in Italy: For if Mengs or Dietrich were comprehended in this School, there would be nothing peculiar to its manner discovered in their works. And it is therefore necessary to confine our observations to the more ancient German painters, in whom the Gothic style is conspicuous.

Albert Durer was the first German who corrected the bad taste of his countrymen. He excelled in engraving as well as painting. His genius was fertile, his compositions varied, his thoughts ingenious, and his colours brilliant. His works, though numerous, were finished with great exactness; but as he owed every thing to his genius, and as works of inferior merit were by the false taste of the times preferred to his, it was impossible for him altogether to avoid the faults of his predecessors. He is blamed for stiffness and aridity in his outlines, for little taste or grandeur in his expression, for ignorance of the costume of aerial perspective and of gradation of colours; but he had carefully studied lineal perspective, architecture, and fortification.

John Holbeen or Holbein, nearly contemporary with Albert Durer, painted in oil and water colours. He excelled chiefly in history and in portrait painting. His colours are fresh and brilliant, and his works are highly finished; but in his historical subjects, his draperies are not in so good a taste as those of Albert Durer.

19 The Flemish school.

The Flemish school is recommended to the lovers of the art by the discovery, or at least the first practice, of oil painting. Van Mander gives us the account of this wonderful discovery in the following words: "John Van Eyck was so excellent a chemist, that he discovered a method of varnishing his distemper colours with a varnish, which was made of some oils, and was very pleasing on account of the gloss and lustre it gave them. Many artists in Italy had vainly attempted to find out that secret; they never hit on the true method. It happened once that John, in his usual manner, having highly finished one of his pictures on boards, and having varnished it with his new invented varnish, exposed it to dry in the sun; but whether the boards were not well joined, or whether the heat of the sun was too violent, the boards split asunder and opened in the junctures. John saw with concern that his work was spoiled, and resolved to contrive something against future accidents of the same kind. Being disgusted at distemper painting and varnishing, he thought of a varnish that might dry without sunshine; and having tried many oils and substances, he found that lintseed and nut oil dried better than any other. He boiled them with some other drugs, and produced the best varnish in the world. Ever bent on improvements, he found, after much inquiry, that colours mixed with these oils worked and dried extremely well, and when dried would be

 be water-proof. He observed likewise, that these oils would animate and give them a gloss and lustre without any farther varnishing." The truth, however, of this account is now very much questioned; and it is even proved by the manuscripts of Theophilus Presbyter, and also by some old oil paintings in England, that this method of painting was discovered long before the time of John Van Eyck. At the same time we admit, that John and his brother Hubert may have been the first who brought oil painting into general practice, not only by showing the excellence of which it was susceptible, but also by making several improvements on the art. And this is the more probable, from the great reputation which their pictures acquired over all Europe, by the softness and delicacy of their colours. The attention of the Italian painters was chiefly excited, insomuch that Antoine de Messina performed a journey into Flanders for the express purpose of acquiring the confidence of John Van Eyck, and of discovering the secret.

John de Bruges was the founder of painting as a profession in Flanders; Peter Paul Rubens was the founder of the art. This extraordinary person produced an immense number of works. He excelled equally in historical, portrait, and landscape painting; in fruits, flowers, and in animals. He both invented and executed with the greatest facility; and to show the extent of his powers, he frequently made a great number of sketches on the same subject altogether different, without allowing any time to elapse between them. The works of Rubens were destitute of that soft inspiration, productive of sweet and pleasant effects, so conspicuous in the works of Raphael; but he possessed that sprightliness of genius and strength of mind which is ever ready to burst forth in wonderful and astonishing effects. His figures appear to be the exact counter-part of his conceptions, and their creation nothing more than a simple act of the will.

His talent for design is unjustly censured, for on every occasion his design is noble and easy. He had great knowledge of anatomy, but he was hurried away by the impetuosity of his imagination and the ardour for execution; he preferred splendor to the beauty of forms, and sacrificed correctness of design too often to the magic of colours. In short, his qualities suppose a mind full of fire and vigour, rather than accuracy or profound thought. His drapery may be considered rather as fine than properly adapted to his figures; for, in the language of the art, to *clothe* and to *give drapery* are not synonymous terms. A portrait painter may excel in clothing his personages, while he is totally incapable of giving good drapery to an historical painting. His chief merit consists in colouring; though in this branch of the art he has not equalled Titian. He is the first among painters eminent for pomp and majesty; the first among those who speak to the eye, and the power of the art is often carried by him almost to enchantment.

It is evident from the works of Rubens, that his method of painting was to lay the colours in their place, one at the side of another, and mix them afterwards by a slight touch of the pencil. Titian mingled his tints as they are in nature, in such a manner as to make it impossible to discover where they began or terminated; the effect is evident, the labour is concealed. Thus Rubens is more dazzling, and Titian more harmonious. In this part, the first excites the attention, the second fixes it. The carnations of Titian resemble the blush of nature; those of Rubens are brilliant and polished like satin, and sometimes his tints are so strong and separated as to appear like spots.

"Rubens (says Sir Joshua Reynolds) is a remarkable instance of the same mind being seen in all the various parts of the art. The whole is so much of a piece, that one can scarce be brought to believe but that if any one of them had been more correct and perfect, his works would not be so complete as they appear. If we should allow a greater purity and correctness of drawing, his want of simplicity in composition, colouring, and drapery, would appear more gross."

In his composition his art is too apparent. His figures have expression, and act with energy, but without simplicity or dignity. His colouring, in which he is eminently skilled, is notwithstanding too much of what we call *tinted*. Throughout the whole of his works there is a proportionable want of that nicety of distinction and elegance of mind, which is required in the higher walks of painting; and to this want it may be in some degree ascribed, that those qualities which make the excellency of this subordinate style appear in him with their greatest lustre.—Indeed the facility with which he invented, the richness of his composition, the luxuriant harmony and brilliancy of his colouring, so dazzle the eye, that, whilst his works continue before us, we cannot help thinking that all his deficiencies are fully supplied.

The Flemish school, of which Rubens is the greatest master, is remarkable for great brilliancy of colours and the magic of the *claro-obscuro*. To these may be joined a profound design, which is yet not founded on the most beautiful forms; a composition possessed of grandeur, a certain air of nobleness in the figures, strong and natural expressions; in short, a kind of national beauty, which is neither copied from the ancients nor from the Roman nor Lombard schools, but which deserves to please, and is capable of pleasing.

20 The Dutch school.

To speak in general terms, and without regarding a great number of exceptions, the Dutch school carries none of the above qualities to great perfection, except that of colouring. Far from excelling in the beauty of heads and forms, they seem chiefly to delight in the exact imitation of the lowest and most ignoble. Their subjects are derived from the tavern, the smith's shop, and from the vulgar amusements of the rudest peasants. The expressions are sufficiently marked; but it is the expression of passions which debase instead of ennobling human nature. One would think that they practised the art of degrading the bodies and souls of men.

It must be acknowledged, at the same time, that the Dutch painters have succeeded in several branches of the art. If they have chosen low objects of imitation, they have represented them with great exactness; and truth must always please. If they have not succeeded in the most difficult parts of the claro-obscuro, they at least excel in the most striking, such as in light confined in a narrow space, night illuminated by the moon or by torches, and the light of a smith's forge. The Dutch understand the gradations of colours; and by their knowledge of contrast they have arrived at the art of painting light itself. They have no rivals in

in landscape painting, considered as the faithful representation or picture of a particular scene; but they are far from equalling Titian, Poussin, Claude Lorrain, &c. who have carried to the greatest perfection the ideal landscape, and whose pictures, instead of being the topographical representation of certain places, are the combined result of every thing beautiful in their imagination or in nature. The Dutch, however, distinguish themselves by their perspective, by their clouds, sea-scenes, animals, fruits, flowers, and insects; and they excel in minature painting, In short, every thing which requires a faithful imitation, colour, and a nice pencil, is well executed by the Dutch painters.

Holland has also produced history painters, as Octavius Van Been, and Vander Hillt the rival of Vandyke, and perhaps his superior: but it is not in the works of those artists that we find the character of the Dutch school.

Neither is the origin of their style to be derived from the works of Lucas of Leyden, though, from the time he flourished, viz. about the end of the 15th century, he may be considered as the patriarch of the Dutch school. Lucas painted in oil, in water colours, and on glass; and the kinds of his painting were history, landscape, and portrait. His picture of the Last Judgment is preserved in the Hotel-de-Ville of Leyden; it possesses vast merit in point of composition, and a great variety of figures.

If miniature painting be considered as a characteristic of the Dutch school, Cornelius Polembourg may be regarded as the father of it. He possessed the colour, delicacy of touch, and disposition of the claro-obscuro, which chiefly distinguish this school; and if any thing is to be added, it is want of correctness in his design.

But if the choice of low figures is its chief characteristic, this is to be found in the greatest perfection in the works of the celebrated Rembrandt Vanryn; and it is the more offensive in this artist, as his compositions frequently required an opposite choice of figures. As his father was a miller near Leyden, his education must altogether have depended on the exertion of great talents and the study of nature. He studied the grotesque figure of a Dutch peasant or the servant of an inn with as much application as the greatest masters of Italy would have studied the Apollo of Belvidere or the Venus de Medicis. This was not the manner of elevating himself to the noble conceptions of Raphael; but it was acquiring the imitation of truth in vulgar painting.

"Rembrandt (says M. Descamps) may be compared to the great artists for colour and delicacy of touch and claro-obscuro. It appears that he would have discovered the art, though he had been the first person that ever attempted it. He formed to himself rules and a method of colouring, together with the mixture of colours and the effect of the different tones. He delighted in the great oppositions of light and shade; and he seems to have been chiefly attentive to this branch of the art. His workshop was occasionally made dark, and he received the light by a hole, which fell as he chose to direct it on the place which he desired to be enlightened. On particular occasions he passed behind his model a piece of cloth of the same colour with the ground he wanted; and this piece of cloth receiving the same ray which enlightened the head, marked the difference in a sensible manner, and allowed the painter the power of augmenting it according to his principles.

"Rembrandt's manner of painting is a kind of magic. No artist knew better the effects of different colours mingled together, nor could better distinguish those which did not agree from those which did. He placed every tone in its place with so much exactness and harmony, that he needed not to mix them, and so destroy what may be called the flower and freshness of the colours. He made the first draught of his pictures with great precision, and with a ture of colours altogether particular: he proceeded on his first sketch with a vigorous application, and sometimes loaded his lights with so great a quantity of colour, that he seemed to model rather than to paint. One of his heads is said to have a nose nearly as much projected as the natural nose which he copied."

Such is the power of genius, that Rembrandt, with all his faults, and they are enormous, is placed among the greatest artists by M. Descamps, who saw his works, and was himself an artist. It is necessary to observe, that if Rembrandt was ignorant of the essential parts of his art, or neglected them, he was yet acquainted with expression, which alone was capable of giving animation to his works. His expressions are not noble, but they are just, lively, and executed with great judgment.

[illegible] de Laer, a miniature painter, and who made ice of his subjects from common life, deserves a distinguished place in the Dutch school. He painted hunting scenes, the attacks of robbers, public festivals, landscapes, and sea-views; and he ornamented his pictures with old ruins, and enriched them with figures of men and animals. He had a correct design, and employed vigorous and lively colouring.

Van Ostade, although born at Lubeck, Gerard Dow, Metzu, Miris, Wouwermans, Berghem, and the celebrated painter of flowers Van-Huysum, belong to the Dutch school.

The greater part of the schools of which we have treated have no longer any existence. Italy alone had four schools, and there only remain at present a very few Italian artists known to foreigners. The school of Rubens is in vain sought for in Flanders. If the Dutch school still exists, it is not known beyond the precincts of Holland. Mengs a German artist has made himself famous in our days; but it was in Italy that he chiefly improved his talents and exercised his art. M. Dietrich another German, has made himself known to strangers: but two solitary artists do not form a school.

21 The English school.

A new school is formed in our times and in our own country, called the *English school*. It is connected with the academy in London, instituted in 1766 by letters patent from the king, and formed only in 1769. Sir Joshua Reynolds is the undoubted founder of it. His works give him a distinguished rank among the artists of the present age, and exhibit a genius in their author which has seldom been surpassed: but the effects which he has contrived to give to them by the formation of a new school, and by the good principles which his discourses to academicians, and his example as a painter, have disseminated, will secure his reputation as long as England shall esteem the advantages and the worth of great abilities. The English taste appears to be formed on the great masters

of

Schools. of the Italian and the Flemish schools. Sir Joshua was a great admirer of Michael Angelo, and particularly recommends him to the attention of the academicians. "I feel (says Sir Joshua), a self-congratulation in knowing myself capable of such sensations as he intended to excite. I reflect, not without vanity, that these discourses bear testimony of my admiration of that truly divine man; and I should desire that the last words which I should pronounce in this academy, and from this place, might be the name of—*Michael Angelo*." But though he thus enthusiastically admired this very great man, yet he allows, what cannot indeed be denied, that he was capricious in his inventions: "and this (says he) may make some circumspection necessary in studying his works; for though they appear to become him, an imitation of them is always dangerous and will prove sometimes ridiculous. 'In that dread circle none durst tread but he.' To me, I confess, his caprice does not lower the estimation of his genius, even though it is sometimes, I acknowledge, carried to the extreme: and however those eccentric excursions are considered, we must at the same time recollect, that those faults, if they are faults, are such as never could occur to a mean and vulgar mind; that they flowed from the same source which produced his greatest beauties; and were therefore such as none but himself was capable of committing; they were the powerful impulses of a mind unused to subjection of any kind, and too high to be controuled by cold criticism.

The effect of Sir Joshua's discourses is visible in the pictures of this school. The Death of General Wolf, the Departure of Regulus for Carthage, the Arrival of Agrippina, and some other subjects, are decided proofs that the English school is acquainted with greatness of style, boldness of expression, and the art of managing a great number of figures. It will be fortunate for the painters of this school, if, more rigid with regard to their forms than ambitious of poignant and astonishing effects, they support the character which they have already acquired. But although England had not enjoyed this brilliant success in painting, she would have immortalized herself by the excellency of her engravings.

It is easy to perceive in all those schools the cause of the character which distinguishes them. In the Roman school, it is the excellent education of its first masters, together with the precious remains of antiquity found in the ruins of ancient Rome. In the Venetian school, the magnificence derived from the commerce of the east, the frequency of feasts and masquerades, and the necessity of painting to the rich and luxurious, who were accustomed to behold these magnificent objects, were the causes of its gaudy taste. In the Dutch school, the peculiarity of its grovelling manner may be accounted for from the habits of the artists. Accustomed to visit taverns and workshops, and having most commonly exposed to their view low and grotesque figures, they represent in their pictures the objects which were most familiar to them in life.

"Beauty (says a French writer *) ought to be the characteristic of the English school, because the artists have it often exposed to their view. If this beauty is not precisely similar to that among the ancients, it is not inferior to it. The English school should also distinguish itself for truth of expression; because the liberty enjoyed in that country gives to every passion its natural and unbiassed operation. It will probably long preserve its simplicity unpolluted by the pomp of theatrical taste and the conceit of false graces, because the English manners will long preserve their simplicity.

* Encyclop. Beaux Arts, tom. 1.

"Examine the picture of a Frenchwoman (continues he) painted by an artist of that nation, and you will generally find, in place of expression, a forced grin, in which the eyes and the forehead does not partake, and which indicates no affection of the soul. Examine the picture of an Englishwoman done by one of their painters, and you observe an elegant and simple expression, which makes you at once acquainted with the character of the person represented."

Comparison between the Ancient and Modern.

### SECT. III. *Comparison between the Ancient and Modern Painting.*

No person of judgment or taste hesitates to give the superiority to the ancient sculpture; but the moderns comfort themselves with refusing the same superiority to the Greek artists in the art of painting. The small number of their productions which remain, and the probable conjectures which may be formed concerning those which have perished, go the length to prove that the Greek painters conducted themselves on other principles than those which have received the sanction of custom and the force of laws in our schools. But this censure might be applied with equal justice to Homer as an epic poet, and to Sophocles and Euripides as writers of tragedy.

The principal difference between the ancient and modern manner of painting consists in the complication of figures, and the pompous decoration of scenery which prevails in the modern, when compared with the unity and simplicity of the ancient painters. This simplicity, however, does not seem to arise from the want of capacity, but from a choice, as Polygnotus, one of their most ancient painters, represents in one of his pieces the siege of Troy, and in another the descent of Ulysses into hell; but they soon decided in favour of simplicity, and their pieces generally contain one or two figures, and very rarely more than three or four.

Poetry in this particular is conducted on very different principles. A poet may with great propriety multiply his characters, and enter into details of a variety of actions, because the whole of his characters and actions do not occupy the mind of his reader at the same time. The whole of his art consists in making one naturally succeed another; but every part of the poem which contains a separate transaction would make a picture capable of fixing the attention. In painting, the eye takes in the whole; and it is by no means satisfied if 20 or 30 figures are presented to it, which it cannot possibly comprehend. It is in vain to group the figures, or to call the attention to the principal object by a greater degree of light; the spectator is anxious to examine every object which is presented to him; and if they are not to be examined, for what reason are they painted? An excellent piece, at the same time, consisting of a great number of figures, will give pleasure; but it is accompanied with that fatigue which one experiences when he runs over a gallery furnished with a great variety of excellent pictures.

Those

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Thoſe obſervations on the attention of the ſpectator led the Greeks to make ſimilar ones on the attention of the artiſt. They perhaps thought that the painter who had to execute a great variety of figures in the ſame work, could not ſtudy each of them with equal accuracy and care; and of conſequence that he might produce ſomething aſtoniſhing in the extent, and yet diſguſting in the detail.

This difference, however, between ancient and modern painting, cannot give any decided principle to determine on their comparative merit. We are accuſtomed to behold aſſemblages in nature; and it is a fact, that even in affecting ſcenes a great number of figures may not only be brought together, but that they may heighten the diſtreſs. It is ſuppoſing a picture to have little effect, to imagine that we can coolly, and with the ſame kind of attention, examine the principal and the acceſſory figures. If it is highly finiſhed, our whole ſoul muſt be abſorbed in that object which the artiſt intended to be moſt conſpicuous; and if we give any attention to the ſurrounding figures, we ſhall conſider them as ſpectators of the ſame ſcene, and derive from them an addition of ſympathy and of feeling. The whole queſtion in this particular point of view amounts to this, that the moderns have choſen a more difficult part; and if they have executed it with ſucceſs, their merit is greater. And this obſervation will hold good, unleſs it can be proved that it is utterly impoſſible to make an aſſemblage of figures lead to one general and common effect.

The proper manner of deciding the comparative merit of the ancients and moderns, is to conſider, as far as we have ſufficient data to go upon, to what degree the ancients excelled in the particular departments of this art. There are two ſources from which we can derive information; namely, from the morſels of antiquity which yet remain, and from what the ancient writers have ſaid on the ſubject of painting, both of which are extremely defective. It is allowed, however, by every ſkilful perſon who has viewed the remains of ancient paintings, that none of them appear to be the performances of ſuperior artiſts, notwithſtanding much merit in the deſign and accuracy in the drawing, which indeed ſeems to have been habitual to almoſt every ancient artiſt. The beſt among theſe paintings (according to Sir Joſhua Reynolds), "the ſuppoſed marriage in the Aldrobandine palace," is evidently far ſhort of that degree of excellence undoubtedly implied in the deſcriptions of ancient authors, and which from them we are fairly led to expect.

Still more defective, if poſſible, is this laſt ſpecies of evidence: for we have no direct treatiſe remaining on the ſubject by any of the ancients, although many were compoſed by their artiſts. The paſſages from which we are to decide are, either the curſory remarks of writers not expreſsly treating on the ſubject of painting, or the deſcriptions of thoſe who at beſt can rank but as *amateurs* of a faſhionable art. From theſe indeed we may pretty ſafely aſſert the degree of excellence which the paſſages imply; but we ſhould reaſon very inconcluſively, were we to deny them any higher or any other merit than appears to be ſtrictly contained in theſe ſcattered obſervations. Let any one for a moment place the modern painters in his mind in the ſame ſituation as the ancients, and he will quickly decide on the truth of theſe remarks.

Nevertheleſs, it is neceſſary on this ſubject to derive ſome concluſions from the information which is occaſionally given in ancient authors. That the ancients paid a particular attention to deſign, would be evident from the manner in which they ſpeak of this department of the graphic art, even though the moderns were not in poſſeſſion of ſuch remaining proofs of their excellence herein (though by artiſts of an inferior claſs), as to place this point beyond the reach of doubt.

Indeed, when it is conſidered that, with reſpect to freedom and correctneſs of outline, painting and ſculpture are very nearly connected; that Phidias and Apelles were nearly contemporaries; that many of the ancient painters, ſuch as Zeuxis, Protogenes, Apelles, &c. were accuſtomed to modelling for the purpoſe of ſculpture or of caſting; that the extreme elegance of deſign in the ancient ſtatues is ſo notorious as to be the acknowledged model even for modern artiſts; and that theſe ornaments of ſculpture were well known and univerſally admired among the ancients—we ſhall have little heſitation in admitting their equality with the moderns ſo far as deſign is concerned. But ſhould any doubt remain on this point, the drawings from the antiquities of Herculaneum will be ſtriking proofs that truth, elegance, and ſpirit, in a degree rarely to be met with among the moderns, were habitual even to the common run of artiſts in the declining age of ancient painting.

The ancients excelled moreover not merely in the common and obvious parts of deſign; but they appear to have had no inconſiderable degree of ſkill in the art of *foreſhortening*. The performance of Pauſias is a proof of this: *Fecit autem grandes tabulas ſicut ſpectatam in Pompeii porticibus boum immolationem. Eam enim picturam primus invenit, quam poſtea imitati ſunt multi, equavit nemo. Ante omnia, cum longitudinem bovis oſtendere vellet, adverſum eum pinxit, non tranſverſum, et abunde intelligitur amplitudo. Dein cum omnes qui volunt eminentia videri, candicantia faciant, coloremque condant, hic totum bovem atri coloris fecit; umbræque corpus ex ipſo dedit; magna prorſus arte in æquo extantia oſtendens et in confracto ſolida omnia.*

Nor will it be difficult to ſhow, that the ancient painters were not inferior to the moderns in *expreſſion*. The ſtate of ſculpture alone among the ancients would almoſt furniſh a deciſive proof that the ſiſter art of painting could not be deficient. Among the ancient ſtatues which yet remain, expreſſion is carried to a wonderful height; not merely the features of the face, but almoſt every muſcle of the body, combining to enforce the idea intended to be conveyed.

Mr Webb * very properly obſerves, that "the ancients thought characters and manners ſo eſſential to painting, that they expreſsly term *picture* an art deſcriptive of manners. Ariſtotle in his *Poetics* ſays of Polygnotus, that he was a painter of the manners; and objects to Zeuxis, his weakneſs in this part." We have in Philoſtratus the following deſcription of a picture: "We may inſtantly (ſays he) diſtinguiſh Ulyſſes by his ſeverity and vigilance; Meneláus by his mildneſs; and Agamemnon by a kind of divine majeſty. In the ſon of Tydeus is expreſſed an air of freedom; Ajax is known by his ſullen fierceneſs; and Antilochus by his alertneſs. To give to theſe ſuch ſentiments and actions as are conſequential from their peculiar characters, is the ethic of painting."

* *On Painting and Poetry*, p. 149.

Another

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Another instance of excellence in expression among the ancient paintings was the Medea of Timomachus. She was painted about to kill her infants. Ausonius speaks with admiration of the mingled expression of anger and maternal fondness in her face and manner.

*Immanem exhausit rerum in diversa laborem*
*Fingeret affectum matris ut ambiguum,*
*Ira sub est lachrymis, miseratio non caret ira,*
*Altere utrum videas ut sit in altere utro.*

It may not be amiss, however at this period of our inquiry, to make some observations on the testimonies of ancient authors respecting this subject.

It is certainly true, that when the works of an ancient artist are praised for any real or supposed merit, the commendations will be relative to the degree of perfection to which the art had arisen at the time, and to the opportunities of information, the taste, and judgement of the person who bestows them. Excellence will always be ascribed to him who leaves his cotemporaries far behind; and those performances will often be considered as supremely beautiful which exceed in beauty all that have gone before.

In like manner, a person of natural sensibility, but who has been accustomed all his life to performances of an inferior stamp, will be in raptures at any which much exceed the best he has heretofore been taught to [illegible], and whatever opportunities of information he may have, his evidence will not be of much weight, if he do not possess a sufficient degree of taste and judgement to use them properly

In ascertaining therefore the degree of credit due to the praises bestowed on any performance in a branch of the fine arts, we must take into consideration the general state of the art at the time, and the competence of the person who bestows the praise.

No slight degree of probability, however, may be attained on both these points, by attending to a circumstance not generally noticed, viz. that in an advanced state of the art, and when the observer is acquainted with his subject, the praise will seldom be given in [illegible]se, general, and comprehensive expressions; but the terms in which it is conveyed will be characteristic and determinate, and often technical; they will frequently show the state of the art, by marking the subdivisions and the skill of the observer by judicious discrimination. When, added to these, the latter can resort for comparison to any existent standard of perfection, his praise may fairly be adopted in its full extent, and regarded as evidence upon the point in question.

To apply these observations to painting, it is clear, with respect to the most difficult, the most fundamental, and the highest in rank among the departments of the art, viz. design and expression, that the ancients were fully equal to the moderns; and their expressions of praise must be allowed to imply an equal degree of absolute skill, with similar expressions, if applied to the great masters of modern art. It is also clear that painting was extremely cultivated among the ancients, and that their good painters were more esteemed than artists of equal merit in modern times; that what we should term gentlemen artists were frequent with them *(apud Romanos quoque honos mature huic arti contigit)*; and that the expression of the ancient connoisseurs evince much theoretical and technical knowledge of the art, and display a distribution of its parts almost as minute, complete, and scientific, as the present state of it can boast.

With regard to colouring, the praises of the ancient authors chiefly relate to the style of it as exerted upon single figures or particular tints. It may therefore be doubted whether the ancients were possessed of the art of distributing their colours through the whole of a picture, so as to produce an harmony and general tone of colouring similar to that which we admire in the Lombard and Flemish schools. The present remains of ancient paintings do not appear to warrant any such conclusions; but being undoubtedly the works of inferior hands, their authority is very small when alleged against the general or particular merit of the ancient artists. The following extracts will be sufficient to evince, that the ancients did attend to this technical branch of colouring.

Indeed the modern technical expressions appear borrowed from the following passage of Pliny, which may be regarded as decisive on the subject. *Tandem sese ars ipsa distinxit, et invenit* lumen atque umbras, *differentia colorum alterna vice sese excitante. Dein adjectus est splendor; alius hic quam lumen; quem quia inter hoc et umbram esset, appellaverunt tonon. Commissuras vero colorum et transitus,* harmogen. The *lumen atque umbras* of this passage might have been regarded as merely descriptive of the light and shade necessary to relieve single figures, if it were not for the subsequent definition of *tone*. The *harmogen* of Pliny means the *handling* or skilful blending and softening colours into one another, rather than what we now call *harmony*.

Lucian †, in his fine description of that spirited painting by Zeuxis of the male and female centaurs, after relating the treatment of the subject itself, proceeds to notice the technical execution of the picture; and he praises particularly the truth and delicacy of the drawing, the perfect blending of the colours, the skilful shading, the scientific preservation of size and magnitude, and the equality and harmony of the proportions throughout the whole piece.

† In his *Zeuxis*.

Painters, says Plutarch, increase the effect of the light and splendid parts of a picture by the neighbourhood of dark tints and shades. And Maximus Tyrius observes, that bright and vivid colours are always pleasant to the eye; but this pleasure is always lessened if you omit to accompany them with somewhat dark and gloomy. These passages seem to imply a knowledge of the use of cold and dark tints even where a brilliancy of tone is required. The best among the ancient painters, however, seem to have preferred a chaste and sober style of colouring to the gaudiness and flutter of the later artists.

Upon the whole, therefore, with respect to colouring as employed upon single figures, as the ancients were fully as competent to judge of excellence herein as the moderns; as the expressions of the ancient connoisseurs are very warm in praise of the colouring of many of their painters; as they appear also to have attended very much to the art of colouring; and, moreover, as probable evidence can be adduced that they attended to miniature painting—a considerable degree of merit may be allowed them in the use of the colours they possessed.

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Chiaro-fcuro, or the art of placing and proportioning light and fhade in fuch a manner as to produce a pleafing effect, independently of any other circumftance connected with the picture, has been commonly deemed a characteriftic difference between the knowledge of ancient and modern painters. On this fubject the works of the ancients now remaining give little or no information; hence Sir Jofhua Reynolds obferves, "that this, which makes fo confiderable a part of the modern art, was to them totally unknown. If the great painters had poffeffed this excellence, fome portion of it would have infallibly been diffufed, and have been difcovered, in the works of the inferior rank of artifts which have come down to us, and which may be confidered as on the fame rank with the paintings that ornament our public gardens" But the accounts of the places where thefe paintings have been found, make it evident that they were thus ornamented at a very confiderable expence. The generality of them confift of fingle figures; fome of them of two or three figures, generally relieved by an uniform ground; and, except in a few inftances, evidently defigned as mere reliefs to a compartment, and anfwering, as near as may be, the ftuccoed ornaments in our modern rooms; nor do any of them feem the works of artifts equal in their day to thofe at prefent employed on the painted cielings of private houfes.

The Abbé du Bos maintains, on the other hand, that what Pliny and other ancient writers fay concerning the claro-obfcuro and the delightful diftribution of light and fhade, is altogether decifive; and that their writings are full of fo many probable circumftances, that it cannot be denied that the ancients at leaft equalled the moft celebrated of the moderns in this part of the art.

On the examination of the greater part of the paffages from antiquity, it is evident that they may relate to the light and fhade of fingle figures, without involving what is now called the fcience of the claro-obfcuro. The paffage of Pliny, however, already quoted, and feveral others, go very near to prove that this branch of painting was underftood among the ancients. The dark, the light, and mezzotint are evidently and accurately defcribed in that paffage.

Equally ftrong is that expreffion in Quintilian: *Zeuxis luminum umbrarumque rationem inveniffe traditur.* This cannot well be otherwife tranflated than by the *fcience* of light and fhade.

That fome technical knowledge of the effect producible by *maffes* of light and fhade was poffeffed by the ancients, appears indubitable from the paffages adduced: to what extent it was carried cannot now be afcertained. In all probability they were much inferior in this refpect to the moderns; otherwife, altho' much fcience of this kind could hardly be expected from the trifling performances that remain, much more would have occurred on the fubject, it would have been more largely dwelt on, and more precifely expreffed among the obfervations of ancient authors on the beft paintings of the ancient mafters.

Neither is there fufficient evidence that the ancients were eminent in that important branch of the compofition of a picture, which confifts in diftributing the figures and objects in groups or maffes. There are few examples of this difficult branch of the art among the remaining antiquities; and indeed from the paucity of the figures introduced in the generality of thefe ancient paintings, there is little room to expect them. But what makes it ftill more doubtful whether the ancients attained any degree of eminence in grouping is, that among the many paintings of thefe great mafters enumerated by Pliny, Lucian, or Philoftratus, there is none of them praifed for this fpecies of excellence. This, however, it muft be confeffed, may as well arife from want of knowledge in the writer as of fkill in the artift; for in a picture found in Herculaneum, which reprefents in all probability the education of Achilles, the figure of an old man holding a child on his knees, together with that of a woman behind him, form a very agreeable group. A work of the fame collection, painted in one colour on marble, confifts of five figures grouped very much after the modern idea, if it were not that three of the heads are at the fame height. It is extremely probable, that this morfel had been the copy of a picture finifhed in the pureft times of the art. But although it were proved that the ancients did not attempt grouping their figures, it is ftill uncertain whether this might not arife from their peculiar and perhaps excellent tafte in the arts. Wifhing to enjoy in the fulleft manner their painted figures as they enjoyed the afpect of a ftatue, they took care that every figure fhould be detached from another in the fame picture, which permitted them to give their objects more relief, and to render them more diftinct to the eye of a diftant fpectator.

We are not therefore to conclude, that they were entirely ignorant of grouping, on the one hand; or that they declined the execution of it from want of fkill, on the other. Indeed it actually appears to have been technically attended to by them, whatever might be their comparative excellence in it; for Apelles is exprefsly afferted by Pliny to have been inferior to Melanthius in compofition (*de difpofitione*); and one of their paintings, mentioned by the fame author, is faid to have contained one hundred figures; but this unwieldy number muft have been offenfive, if they were not grouped with fome fkill.

From the connection between the fifter arts of poetry, painting, and fculpture, and the admirable performances of the ancients in the other two departments of the fine arts, it is reafonable to conclude that the ancient painters were not deficient in invention. Many inftances, were it neceffary, might be collected in fupport of their well-founded claim to this branch of the art; but it will be fufficient to obferve, that as invention is rather a natural endowment than an acquired talent, and as the ancients univerfally feem to be at leaft equal to the moderns in the gifts of genius and good fenfe, we cannot but admit, on their part, an equality with ourfelves fo far as invention is concerned.

Very nearly connected with the fubject of invention is that of the *coftume*; by which is meant an attention to probability with refpect to times, places, objects, perfons, and circumftances in the tranfaction reprefented.

The ancient paintings now remaining, fo far from exhibiting any proofs of attention to this important branch of the art, are full of grofs violations of probability,

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bability, and representations of impossible connection. But very little stress is to be laid on these instances; first, because they are evidently the performances of artists of no reputation; secondly, because none of them to which this objection can be made are regular representations of any person or transaction; and thirdly, because, as they were (for the most part) manifestly intended as ornaments to apartments, the taste of the owner, and not of the artist, would of course be chiefly consulted. Nothing, however, can be more clear than that the ancients required an attention to probability in the works of their artists; and from the manner in which their writers express themselves on the subject (not so much recommending the practice of it as taking it for granted), we may reasonably conclude, that their best painters were seldom guilty of any gross violation of the costume. *Sint ficta simillima veris* was an apophthegm generally known, and when known must have been universally admitted.

The principles of the costume are well expressed and illustrated by Horace in the first lines of his Art of Poetry; and Vitruvius, lib. vii. chap. 5. says, that no pictures can be approved of which have not a resemblance to truth and nature. Whether the ancient painters put in practice a greater share of good sense with respect to the costume than the moderns, cannot now be accurately determined; the advantage seems to be in favour of the former; for, as we shall have occasion more particularly to observe afterwards, the most celebrated of modern painters from Raphael to Sir Joshua Reynolds have been guilty of such flagrant breaches of probability, as would appear astonishing to those who are not in the habit of expecting them.

It has been doubted whether the ancients were acquainted with the science of *perspective*: and if the remains of ancient painting were alone to decide the question, it must be determined against them: for the works of the ancient painters now in possession of the moderns afford no proof of attention to the rules of perspective equal to the performance of a modern sign-painter. The picture of the sacrifice among the Herculanean antiquities, and the fourth of the prints which Bellori has published and described, taken from the paintings in the sepulchre of the Nasonii, are barely tolerable; but the other landscapes (almost the only remaining antique paintings which admit of perspective) are grossly defective in this particular; so much so indeed, that considering the late period when landscape-painting was introduced among the ancients, together with this manifest imperfection in point of perspective of such as are yet extant, we cannot help suspecting the inferiority of the ancients in this respect. In perspective, as in the chiaro-scuro, had good practice been common, some traces would have been discovered in the works of their lowest artists.

And yet some general knowledge of the principles, and some degree of attention to the practice, of perspective, cannot well be denied to the ancients. They were good mathematicians, they were excellent architects, and some of them are celebrated for their skill in scene-painting. Geminus the Rhodian, contemporary with Cicero, was the author of an express treatise on perspective; and Euclid, Heliodorus, Larisseus, Agatharcus, wrote also on the same subject. It is well known, besides, that the ancients practised the art of painting in perspective on walls in the same way that it is now done by the moderns; and Pliny (Nat. Hist. lib. xxxv. c. 4.) says, that one of the walls of the theatre of Claudius Pulcher, representing a roof covered with tiles, was finished in so masterly a manner, that the rooks, birds of no small sagacity, taking it for a real roof, attempted to light upon it. We are likewise told, that a dog was deceived to such a degree, by certain steps in a perspective of Dantos, that expecting to find a free passage, he made up to them in full speed, and dashed out his brains. But what is still more, Vitruvius tells us in express terms by whom and at what time this art was invented. It was first practised by Agatharcus, a contemporary of Æschylus, in the theatre of Athens; and afterwards reduced to certain principles, and treated as a science, by Anaxagoras and Democritus; thus faring like other arts which existed in practice before they appeared in theory.

Portrait-painting seems to have been a principal employment of the first artist whom the ancients have to boast of, since Alexander is said to have permitted no painter but Apelles, and no sculptor but Phidias to take his likeness. Pliny particularizes several instances of Apelles as a portrait painter.

In the drawing and colouring of single figures, to which the ancients paid peculiar attention, they must be allowed to be equal, if not superior, to the moderns. That spirit and animation, ease and dignity, were *common* to the performances of ancient artists, the ancient statues and paintings still remaining most evidently evince; and as they possessed, therefore, all the requisites to excel in portrait-painting, a branch of the art at all times much in request among them, there is good reason to infer, in favour of the ancients, at least an equality with the moderns in this respect.

On the whole, all the principal parts of the art, as purity of design, and beauty and expression in the forms, were not only to be found in the ancient statues, but were actually the foundation of excellence in modern painting; and hence we may conclude that their painters formed on the same models, and very often the same men who excelled in sculpture, were not inferior in those branches of the art. But with regard to the inferior parts, the allurement of colouring, the ingenuity of the claro-obscuro, the splendor of composition, the art of grouping figures, and the nice *handling* of the pencil, the moderns are superior to those ancient painters who have most deserved the notice of their contemporary writers. It is still to be observed, however, that the progress of the arts among the ancients, from the principal parts to the more splendid, was somewhat similar to that among the moderns; and as the painters of the first rank were more immediately the objects of criticism and delight to authors of genius, it is impossible at this distance of time to state any accurate comparison between the ancients and moderns in what may be termed the decay of the art. This is particularly the case with regard to colours, there being in ancient as well as in modern times two epochs; the one comprehending Polygnotus and his immediate successors, and the other the painters both of Greece and Rome after the art began to decay. The colouring of Polygnotus was hard, and his manner had something of wild-

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ness; but his design was in the highest style of perfection. In the succeeding ages the colouring was more varied, more brilliant, more harmonious, and the handling more agreeable; but the design was less elegant and exact. And the true connoisseurs continued to prefer the works of the ancient school, in the same manner that the best writers in our times prefer the works of the Roman and Venetian masters to the more brilliant pictures of their successors. From this statement of facts it is abundantly evident, that from the ancient authors we can form some comparison between the best ancient and modern painters in those things which are most excellent in the art; while in the inferior parts, from the silence of authors, and the loss of paintings, we have no grounds upon which a comparison can be accurately made.

## PART I. Principles of the Art, and the Order of the Artist's Studies.

We have joined these together, because they are like cause and effect; and comprehend both on what parts in the execution of the art the painter is to employ his chief attention, and also the manner in which he is to employ it. We shall not therefore be confined to the dry and abstract, and as it were unembodied principles, but connect them with the useful and agreeable branches of the art, in that order in which it appears to us they should be studied.

### Sect I. *Of Anatomy.*

To ask if the study of anatomy is requisite to a painter, is the same thing as to ask if, in order to learn any science, a man must first make himself acquainted with the principles of it. It would be an useless waste of time to cite, in confirmation of this truth, the authorities of the ancient masters, and the most celebrated schools. A man, who is unacquainted with the form and construction of the several bones which support and govern the human frame, and does not know in what manner the muscles moving these bones are fixed to them, can make nothing of what appears of them thro' the integuments with which they are covered; and which appearance is, however, the noblest object of the pencil. It is impossible for a painter to copy faithfully what he sees, unless he thoroughly understand it. Let him employ ever so much time and study in the attempt, it cannot but be attended with many and great mistakes: just as it must happen to a man, who undertakes to copy something in a language which he does not understand; or to translate into his own, what has been written in another, upon a subject with which he is not acquainted.

It seldom happens, that nothing more is required of a painter than to copy exactly an object which he has before him. In still and very languid attitudes, in which every member is to appear motionless and dead, a living model may, no doubt, yield for a long time a faithful image, and prove an useful pattern to him. But in regard to gestures any way sudden, motions any way violent, or those momentary attitudes which it is more frequently the painter's business to express, the case is quite different. In these a living model can hold but an instant or two; it soon grows languid, and settles into a fixed attitude, which is produced by an instantaneous concourse of the animal spirits. If, therefore, a painter possess not so thoroughly all the principles of anatomy, as to be at all times able to have immediate recourse to them; if he know not the various manners in which the several parts of the human body play, according to their various positions; living models, far from proving an useful pattern to him, will rather tend to lead him astray, and make him lose sight of truth and nature, by exhibiting the very reverse of what is required, or at least exhibiting it in a very faint and imperfect manner. In living models, we often behold those parts slow, which should be very quick; those cold and torpid, which should have the greatest share of life and spirt in them.

Nor is it, as some may be apt to imagine, merely to represent athletic and vigorous bodies, in which the parts are most bold and determined, that anatomy is requisite; it should be understood to represent persons of the most delicate frame and condition, even women and children, whose members are smoothest and roundest, though the parts made known by it are not to be strongly expressed in such objects; just as logic is equally requisite under the polished insinuations of the orator, and the rough arguments of the philosopher.

But it is needless to spend much time in proving, that a painter should be acquainted with anatomy; or in showing, how far his acquaintance with it should extend. For instance, it is unnecessary for him to enter into the different systems of the nerves, blood-vessels, bowels, and the like; parts which are removed from the sight, and which therefore may be left to the surgeon and the physician, as being a guide in the operations of the former and in the prescriptions of the latter. It is enough for the painter, to be acquainted with the skeleton; in other words, with the figure and connection of the bones, which are, in a manner, the pillars and props of the human body; the origin, progress, and shape, of the muscles, which cover these bones; as also the different degrees in which nature has clothed the muscles with fat, for this substance lies thicker upon them in some places than in others. Above all, he should know in what manner the muscles effect the various motions and gestures of the body. A muscle is composed of two tendinous and slender parts, one called the *head*, the other the *tail*, both terminating at the bones; and of an intermediate part, called the *belly*. The action of a muscle consists in an extraordinary swelling of this intermediate part, while the head remains at rest, so as to bring the tail nearer the head, and consequently the part, to which the tail of the muscle is fixed, nearer to that part into which the head is inserted.

There are many motions to effect which several of the muscles (for this reason called *co-operating muscles*) must swell and operate together, while those calculated to effect a contrary motion (and therefore called *antagonist muscles*) appear soft and flaccid. Thus, for example, the biceps and the brachiæus internus labour when

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Michael Angelo intended to give the public a complete treatise upon this subject; and it is no small misfortune, that he never accomplished so useful a design. This great man, having observed, as we are told in his life by Condivi, that Albert Durer was deficient on the subject, as treating only of the various measures and forms of bodies, without saying a word of their attitudes and gestures, though things of much greater importance, resolved to compose a theory, founded upon his long practice, for the service of all future painters and statuaries. And, certainly, no one could be better qualified to give anatomical precepts for that purpose, than he who, in competition with Da Vinci, designed that famous cartoon of naked bodies, which was studied by Raphael himself, and afterwards obtained the approbation of the Vatican, the greatest school of the art we are now treating of.

The want of Michael Angelo's precepts may, in some measure, be supplied by other books written on the same subject by Moro, Cesio, and Tortebat; and lately by Boucherdon, one of the most famous statuaries in France. But nothing can be of equal service to a young painter, with the lessons of some able dissector; under whom, in a few months, he may make himself master of every branch of anatomy which he need to be acquainted with. A course of osteology is of no great length; and of the infinite number of muscles discovered by curious myologists, there are not above 80 or 90, with which nature sensibly operates all those motions which he can ever have occasion to imitate or express. These, indeed, he should closely study, these he should carefully store up in his memory, so as never to be at the least loss for their proper figure, situation, office, and motion.

But there is another thing, besides the dissection of dead bodies, by which a young painter may profit greatly; and that is anatomical casts. Of these we have numbers by several authors; nay, some which pass under the name of *Buonarroti* himself. But there is one in which, above all the rest, the parts are most distinctly and lively expressed. This is the performance of Hercules Lelli, who has perhaps gone greater lengths in this kind of study than any other master. We have, besides, by the same able hand, some casts of particular parts of the human body, so curiously coloured for the use of young painters, as to represent these parts exactly as they appear on removing the integuments; and thus, by the difference in their colour as well as configuration, render the tendinous and the fleshy parts, the belly and the extremities, of every muscle surprisingly distinct; at the same time that, by the various direction of the fibres, the motion and play of these muscles become very obvious; a work of the greatest use, and never enough to be commended! Perhaps, indeed, it would be an improvement, to give the muscles various tints; those muscles especially which the pupil might be apt to mistake for others. For example, though the mastoides, the deltoides, the sartorius, the fascia lata, the gasterocnemii, are, of themselves, sufficiently distinguishable, it is not so with regard to the muscles of the arm and of the back, the right muscles of the belly, and some others, which, either on account of the many parts into which they branch, or of their being interwoven one with another, do not so clearly and fairly present themselves to the eye. But let the cause of confusion to young beginners be what it will, it may be effectually removed, by giving, as already hinted, different colours to the different muscles, and illumining anatomical figures; in the same manner that maps are coloured, in order to enable us readily to distinguish the several provinces of every kingdom, and the several dominions of every prince.

The better to understand the general effect, and remember the number, situation, and play of the muscles, it will be proper to compare, now and then, the anatomical casts, and even the dead body itself, with the living body covered with its fat and skin; and above all things, with the Greek statues still in being. It was the peculiar happiness of the Greeks, to be able to characterize and express the several parts of the human body much better than we can pretend to do; and this, on account of their particular application to the study of naked figures, especially the fine living ones which they had continually before their eyes. It is well known, that the muscles most used are likewise the most protuberant and conspicuous; such as, in those who dance much, the muscles of the legs; and in boatmen, the muscles of the back and arms. But the bodies of the Grecian youth, by means of their constant exertion of them in all the gymnastic sports, were so thoroughly exercised, as to supply the statuary with much more perfect models than ours can pretend to be.

There are a great many exercises, which a young painter should go through while engaged in the study of anatomy, in order to make himself more thoroughly master of that science. For example: The thighs of any figure, a Laocoon for instance, being given, he should add to them legs suitable to that state in which the muscles of the thighs are represented, that is, the muscles which serve to bend and extend the legs, and to effectuate in them such a precise position and no other. To the simple contour of an anatome, or a statue, he should add the parts included by it, and give it a system of muscles conformable to the quality of that particular contour; for every contour denotes some one certain attitude, motion, exertion, and no other. Exercises of this kind would soon establish him in the most fundamental principles of painting, especially if he had an opportunity of comparing his drawings with the statue or cast from which the parts given him to work upon were taken, and thereby discovering and correcting his mistakes. This method is very like that used by those who teach the Latin tongue; when, having given their scholars a passage of Livy or Cæsar already translated into their mother-tongue, to translate back into Latin, they make them compare their work with the original text.

SECT.

Perspective.

## Sect. II. *Of Perspective.*

The study of perspective should go hand in hand with that of anatomy, as not less fundamental and necessary. In fact, the contour of an object drawn upon paper or canvas, represents nothing more than such an intersection of the visual rays sent from the extremities of it to the eye, as would arise on a glass put in the place of the paper or canvas. Now, the situation of an object at the other side of a glass being given, the delineation of it on the glass itself depends entirely on the situation of the eye on this side of the glass; that is to say, on the rules of perspective: a science which, contrary to the opinion of most people, extends much farther than the painting of scenes, floors, and what generally goes under the name of *quadratura*. Perspective, according to that great master da Vinci, is to be considered as the reins and rudder of painting. It teaches in what proportion the parts fly from, and lessen upon, the eye; how figures are to be marshalled upon a plain surface, and fore-shortened. It contains, in short, the whole rationale of design.

Such are the terms which the masters best grounded in their profession have employed to define and commend perspective: so far were they from calling it a *fallacious art*, and an *insidious guide*; as some amongst the moderns have not blushed to do, insisting that it is to be followed no longer than it keeps the high road, or leads by easy and pleasant paths. But these writers plainly show, that they are equally ignorant of the nature of perspective, which, founded as it is on geometrical principles, can never lead its votaries astray: and of the nature of their art, which, without the assistance of perspective, cannot, in rigour, expect to make any progress, nay, not so much as to delineate a simple contour.

When a painter has formed a scene in his mind, and supposed, as it is customary, that the capital figures of this scene lie close, or almost close, to the back of his canvas, he is, in the next place, to fix upon some point on this side of the canvas, from which he would choose his piece should be seen. But in choosing this point, which is called the *point of sight*, regard should be had to its situation to the right or left of the middle of the canvas: but, above all things, to its distance and its height with respect to the lower edge of the canvas; which edge is called the *base line*, and is parallel with the horizontal line that passes through the eye. For by assuming the point of sight, and consequently the horizontal line, too low, the planes upon which the figures stand will appear a great deal too shallow; as, by assuming it too high, they will appear too steep, so as to render the piece far less light and airy than it ought to be. In like manner, if the point of sight is taken at too great a distance from the canvas, the figures will not admit of degradation enough to be seen with sufficient distinctness; and if taken too near it, the degradation will be too quick and precipitate to have an agreeable effect. Thus, then, it appears, that no small attention is requisite in the choice of this point.

When a picture is to be placed on high, the point of sight should be assumed low, and *vice versa*; in order that the horizontal line of the picture may be, as near as possible, in the same horizontal plane with that of the spectator; for this disposition has an amazing effect. When a picture is to be placed very high, as, amongst many others, that of the Purification by Paulo Veronese, engraved by le Fevre, it will be proper to assume the point of sight so low, that it may lie quite under the picture, no part of whose ground is, in that case, to be visible; for, were the point of sight to be taken above the picture, the horizontal ground of it would appear sloping to the eye, and both figures and buildings as ready to tumble head foremost. It is true, indeed, that there is seldom any necessity for such extraordinary exactness; and that, unless in some particular cases, the point of sight had better be rather high than low: the reason of which is, that, as we are more accustomed to behold people on the same plane with ourselves, than either higher or lower, the figures of a piece must strike us most when standing on a plane nearly level with that upon which we ourselves stand. To this it may be added, that by placing the eye low, and greatly shortening the plane, the heels of the back figures will seem to bear against the heads of the foremost, so as to render the distance between them far less perceptible than otherwise it would be.

The point of sight being fixed upon according to the situation in which the picture is to be placed, the point of distance is next to be determined. In doing this, a painter should carefully attend to three things: first, that the spectator may be able to take in, at one glance, the whole and every part of the composition; secondly, that he may see it distinctly; and, thirdly, that the degradation of the figures and other objects of the picture be sufficiently sensible. It would take up too much time to lay down certain and precise rules for doing all this, considering the great variety in the sizes and shapes of pictures; for which reason we must leave a great deal to the discretion of the painter.

But there is a point still remaining, which will not admit of the least latitude. This is, the delineation of the picture, when once the point of sight has been fixed upon. The figures of a picture are to be considered as so many columns erected on different spots of the same plane; and the painter must not think of designing any thing, till he has laid down, in perspective, all those columns which are to enter his composition, with the most scrupulous exactness. By proceeding in this manner, he may not only be sure of not committing any mistake in the diminution of his figures according to their different distances, but may flatter himself with the thoughts of treading in the steps of the greatest masters. It is to the punctual observance of these laws, that we are to attribute the grand effect of some paintings by Carpaccio and Mantegna, so careless in other respects; whereas a single fault against them is often sufficient entirely to spoil the works of a Guido, in spite of the sublimity and beauty of his superior style.

Now, as the demonstration of the rules of perspective depends on the doctrine of proportions, on the properties of similar triangles, and on the intersection of planes, it will be proper to put an abridgement of Euclid into the hands of the young painter, that he may

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may understand these rules fundamentally, and not stand confined to a blind practice of them; but, then, there is nothing in this author relative to the art of painting, which may not be easily acquired in a few months. For, as it would be of no use to a painter to launch out into the anatomical depths of a Monro or an Albinus, it would be equally superfluous to perplex himself with the intricacies of the higher geometry with a Taylor, who has handled perspective with that rich profoundness, which we cannot help thinking does a great deal more honour to a mathematician, than it can possibly bring advantage to a simple artist.

But though a much longer time were requisite to become a perfect master of perspective, a painter, surely, ought not to grudge it; as no time can be too long to acquire that knowledge, without which he cannot possibly expect to succeed. Nay, we may boldly affirm, that the shortest road in every art is that which leads through theory to practice. From theory arises that great facility, by means of which a man advances the quicker, in proportion as he is surer of not taking a wrong step; whilst those, who are not grounded in the science, labour on in perpetual doubt; obliged, as a certain author expresses it, to feel out their way with a pencil, just as the blind, with their sticks, feel for the streets and turnings, with which they are not acquainted.

As practice, therefore, ought in every thing to be built upon principle, the study of Optics, as far as it is requisite to determine the degree in which objects are to be illuminated or shaded, should proceed hand in hand with that of perspective: And this, in order that the shades, cast by figures upon the planes on which they stand, may fall properly, and be neither too strong nor too light; in a word, that those most beautiful effects of the chiaro-scuro may run no risk of ever receiving the lie from truth, which sooner or later discovers itself to every eye.

## Sect. III. *Of Symmetry*.

The study of symmetry, it is obvious, should immediately follow that of anatomy; for it would avail us little to be acquainted with the different parts of the human body, and their several offices, were we at the same time ignorant of the order and proportion of those parts in regard to the whole in general, and to each other in particular. The Greek statuaries distinguished themselves above all others, as much by the just symmetry of their members, as by their skill in anatomy; but Polycletes surpassed them all by a statue, called the *Rule*, from which, as from a most accurate pattern, other artists might take measures for every part of the human body. These measures, to say nothing of the books which treat professedly of them, may now be derived from the Apollo of Belvedere, the Laocoon, the Venus of Medicis, the Faunus, and particularly the Antinous, which last was the rule of the learned Poussin.

*Plinii Nat. Hist lib xxxiv. c. 8.*

It is the general opinion of painters, that the ancients were not as happy in representing the bodies of children, as they are allowed to have been in representing those of women and men; especially those of their gods; in which they excelled to such a degree, that with these gods were often worshipped the artists who had carved them. Yet the Venus of Gnidus by Praxiteles was not more famous than her Cupid, on whose account alone people flocked to Thespiæ §. To children, say they, the ancients knew not how to impart that softness and effeminacy which Flammingo has since contrived to give them, by representing their cheeks, hands, and feet, swelled, their heads large, and with scarce any belly. But such critics seem to forget; that these first sketches of nature very seldom come in the painter's way, and that this puny and delicate state has not in its form even the least glimmering of perfection. The ancients never undertook to represent children less than four or five years old; at which age the superfluous humours of the body being in some measure digested, their members begin to assume such a contour and proportion as may serve to point out what they are afterwards likely to be. This observation is confirmed by the children which we meet with in ancient basso-relievos and paintings: for they are all doing one thing or another; like those most beautiful little Cupids in a picture at Venice, who are playing with the arms of Mars, and lifting up the ponderous sword of that Deity; or that little urchin in the Danäe of Caracci, who empties a quiver of its arrows in order to fill it with the golden shower. Now, what can be a greater blunder in point of costume, than to attribute actions, which require some degree of strength and judgment, to infancy, to that raw and tender age so totally unable to govern and support itself?

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§ *Cic. in Verrem, de signis. Strabo,* lib. ix. *Plin. Nat. Hist.* lib. xxxvi. c. 5.

Let a young painter consider the Greek statues ever so often, of whatever character or age they may be represented, it is impossible he should ever consider them without discovering new beauties in them. It is therefore impossible he should copy them too often, according to that judicious motto placed by Maratti on his print called *The school.* This truth was acknowledged by Rubens himself; for though, like one bred, as he was, in the foggy climate of the Low Countries, he generally painted from the life; in some of his works he copied the ancients; nay, he wrote a treatise on the excellency of the ancient statues, and on the duty of a painter to study and imitate them. As to the satirical print, or rather pasquinade, of the great Titian, in which he has represented a parcel of young monkeys aping the group of Laocoon and his sons; he intended nothing more by it than to lash the dulness and poverty of those artists, who cannot so much as draw a figure without having a statue before them as a model.

In fact, reason requires, that an artist should be so much master of his art, as seldom to stand in need of a pattern. To what other purpose is he to sweat and toil from his infancy, and spend so many days and nights in studying and copying the best models; especially the finest faces of antiquity, which we are still possessed of; such as the two Niobes, mother and daughter; the Ariadne, the Alexander, the young Nero, the Silenus, the Nile: and likewise the finest figures; for instance, the Apollo, the Gladiator, the Venus, and others; all which (as was said of Pietro Festa), he should have, as it were, perfectly by heart! With a stock of excellencies like these, treasured up in his memory, he may one day hope to produce something

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thing of his own without a model; form a right judgement of thoſe natural beauties which fall in his way; and, when occaſion offers, avail himſelf properly of them.

It is very injudicious to ſend boys to an academy to draw after naked figures, before they have imbibed a proper reliſh for beautiful proportions, and have been well-grounded in the true principles of ſymmetry. They ſhould firſt learn, by ſtudying the precious remains of antiquity, to improve upon life; and diſcern where a natural figure is faulty through ſtiffneſs in the members, or clumſineſs in the trunk, or in any other reſpect; ſo as to be able to correct the faulty part, and reduce it to its proper bounds. Painting, in this branch, is, like medicine, the art of taking away and adding.

It muſt not, however, be diſſembled, that the methods hitherto laid down are attended with ſome danger: for by too ſlaviſh an attention to ſtatues, the young painter may contract a hard and dry manner; and by ſtudying anatomies too ſervilely, a habit of repreſenting living bodies as ſtripped of their ſkin: for, after all, there is nothing but what is natural, that, beſides a certain peculiar grace and livelineſs, poſſeſſes that ſimplicity, eaſe, and ſoftneſs, which is not to be expected in the works of art, or even in thoſe of nature when deprived of life. Pouſſin himſelf has now and then given into one of theſe extremes, and Michael Angelo very often into the other: but from this we can only infer, that even the greateſt men are not infallible. It is, in ſhort, to be conſidered as one inſtance, among a thouſand, of the ill uſe thoſe are wont to make of the beſt things, who do not know how to temper and qualify them properly with their contraries.

But no ſuch danger can ariſe to a young painter from confining himſelf for a long time to mere deſign, ſo as not to attempt colouring till he has made himſelf maſter of that branch. If, according to a great maſter *, colours in painting are in regard to the eye what numbers in poetry are in regard to the ear, ſo many charms to allure and captivate that ſenſe; may we not affirm, that deſign is in the ſame art what propriety of language is in writing, and a juſt utterance of ſounds in muſic? Whatever ſome people may think, a picture deſigned according to the rules of perſpective and the principles of anatomy, will ever be held in higher eſteem by good judges, than a picture ill deſigned, let it be ever ſo well coloured. Hannibal Caracci ſet ſo great a value upon the art of contour, that, according to ſome expreſſions of his which have reached us, he conſidered almoſt every thing elſe as nothing in compariſon with it. And this his judgement may be juſtified, by conſidering, that nature, though ſhe forms men of various colours and complections, never operates in the motions contrary to the mechanical principles of anatomy, nor, in exhibiting theſe motions to the eye, againſt the geometrical laws of perſpective: a plain proof, that, in point of deſign, no miſtake is to be deemed trifling. Hence we are enabled to feel all the weight of thoſe words in which Michael Angelo, after he conſidered a picture drawn by a prince of the Venetian ſchool, addreſſed Vaſari: "What a pity it is," ſaid he, "that this man did not ſet out by ſtudying deſign!" As the energy of nature ſhines moſt in the ſmalleſt ſubjects, ſo the energy of art ſhines moſt in imitating them.

* Pouſſin, in his *Life* by Bellori.

Imitation.

## Sect. IV. *Of Imitation.*

When you conſider art as the imitation of nature (ſays Mengs), it is not to be underſtood that nature, which is the object, is more perfect than art which imitates it. Nature, it is confeſſed, offers ſome views of which the imitation muſt for ever remain imperfect, as in the inſtance of the claro-obſcuro; but, on the other hand, in every thing relative to beauty of form, imitation may even ſurpaſs nature. Nature, in her productions, is ſubject to many accidents. Art, labouring on paſſive and obedient materials, renders perfect the objects of its creation, chooſes every thing in nature the moſt excellent, and collects the different parts and the different beauties of many individual into one whole. It is ſeldom that we find in the ſame man greatneſs of ſoul and the due proportions of body, vigour, ſuppleneſs, firmneſs, and agility, joined together. Art conſtantly repreſents what is rarely or never to be met with in human nature; regularity in the outlines, grandeur in the forms, grace in the attitudes, beauty in the members, force in the breaſt, agility in the limbs, addreſs in the arms, frankneſs in the forehead, ſpirit in the eyes, and affability over the whole countenance. Let an artiſt give force and expreſſion to all the parts of his ſubject, let him vary this force and expreſſion as different circumſtances make it neceſſary, and he will ſoon perceive that art may ſurpaſs nature. But although this be granted, the artiſt is not to imagine that art is *actually* arrived at this ſupreme degree of perfection, and can proceed no farther. The moderns ſeem never to have perceived the tract pointed out by the ancient Greeks: for, ſince the revival of painting, the true and the agreeable, inſtead of the beautified, have been the objects of cultivation. Still, however, imitation is the firſt part of the art of painting, though not the moſt excellent or beautiful. It is a neceſſary ſtep in the progreſs which leads forward to greater perfection.

A painter ought attentively to conſider, compare together, and weigh in the balance of reaſon and truth, all the different ſtyles of the great maſters; but he ought likewiſe carefully to guard againſt too great a fondneſs for any one of them in particular that he may think proper to adopt; otherwiſe, to uſe the expreſſion of a firſt-rate maſter *, inſtead of the child, he would become the grand child of nature.

* Da Vinci on Painting.

Beſides, his imitation muſt be of generals, and not of particulars. Whatever a young painter's natural diſpoſition may be, whether to paint boldly and freely like Tintoret and Reubens, or to labour his works like Titian or Da Vinci, let him follow it. This kind of imitation is very commendable. It is thus that Dante, at the ſame time that he carefully avoided adopting the particular expreſſions of Virgil, endeavoured to ſeize his bold and free manner, and at laſt caught from him that elegance of ſtyle which has done him ſo much honour.

As to the reſt, nothing ſhould hinder an able maſter from making uſe now and then of any antique, or even modern figure, which he may find his account in employing. Sanzio, in a *St Paul at Liſtra*, ſcrupled

not

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not to avail himself of an ancient sacrifice in basso relievo; nor did Buonarroti himself disdain to use, in his paintings of the Sextine chapel, a figure taken from that famous cornelian which tradition tells us he wore on his fingers, and which was lately in the possession of the most Christian king. Men like these avail themselves of the productions of others in such a manner as to make us apply to them, what La Bruyere said of Despreaux, that one would imagine the thoughts of other men had been of his own creation.

In general, a painter should have his eye constantly fixed on nature, that inexhaustible and varied source of every kind of beauty; and should study to imitate her in her most singular effects. As beauty, scattered over the whole universe, shines brighter in some objects than in others, he should never be without his little book and crayon, in order to make drawings of every beautiful or uncommon object that may happen to present itself; and take sketches of every fine building, every situation, every effect of light, every flight of clouds, every flow of drapery, every attitude, every expression of the passions, that may happen to strike him. He may afterwards employ these things as occasion offer; and in the mean time will have the advantage of acquiring a grand taste.

It is by carefully studying the best masters, and imitating nature, that a painter arrives at the style of perfection which the Italians call *gusto grando*, the French *le beau ideal*, and the English *the great style*.

"A mind (says Sir Joshua Reynolds), enriched by an assemblage of all the treasures of ancient and modern art, will be more elevated and fruitful in resources in proportion to the number of ideas which have been carefully collected and thoroughly digested.

"The addition of other mens judgment is so far from weakening, as is the opinion of many, our own, that it will fashion and consolidate those ideas of excellence which lay in their birth feeble, ill-shaped, and confused; but which are finished and put in order by the authority and practice of those, whose works may be said to have been consecrated by having stood the test of ages.

"When we speak of the habitual imitation and continued study of masters, it is not to be understood that I advise any endeavour to copy the exact peculiar colour and complexion of another man's mind; the success of such an attempt must always be like his who imitates exactly the air, manner, and gestures, of him whom he admires. His model may be excellent, but he himself will be ridiculous; and this ridicule arises not from his having imitated, but from his not having chosen the right mode of imitation.

"It is a necessary warrantable pride to disdain to walk servilely behind any individual, however elevated his rank. The true and liberal ground of imitation is an open field, where, though he who precedes has had the advantage of starting before you, yet it is enough to pursue his course; you need not tread in his footsteps; and you certainly have a right to outstrip him if you can.

"Nor, whilst I recommend studying the art from artists, can I be supposed to mean that nature is to be neglected: I take this study in aid, and not in exclusion of the other. Nature is, and must be, the fountain, which alone is inexhaustible; and from which all excellencies must originally flow.

"The great use of studying our predecessors is to open the mind, to shorten our labour, and to give us the result of the selection made by those great minds of what is grand or beautiful in nature: her rich stores are all spread out before us; but it is an art, and no easy art, to know how or what to choose, and how to attain and secure the object of our choice.

"Thus the highest beauty of form must be taken from nature; but it is an art of long deduction and great experience to know how to find it. I cannot avoid mentioning here an error which students are apt to fall into.

"He that is forming himself must look with great caution and wariness on those peculiarities or prominent parts which at first force themselves on view, and are the marks, or what is commonly called the manner, by which that individual artist is distinguished.

"Peculiar marks I hold to be generally, if not always, defects, however difficult it may be wholly to escape them.

"Peculiarities in the works of art are like those in the human figure; it is by them that we are cognizable and distinguished one from another; but they are always so many blemishes, which, however, both in the one case and in the other, cease to appear deformities to those who have them continually before their eyes. In the works of art, even the most enlightened mind, when warmed by beauties of the highest kind, will by degrees find a repugnance within him to acknowledge any defects; nay, his enthusiasm will carry him so far as to transform them into beauties and objects of imitation.

"It must be acknowledged, that a peculiarity of style, either from its novelty, or by seeming to proceed from a peculiar turn of mind, often escapes blame; on the contrary, it is sometimes striking and pleasing; but it is vain labour to endeavour to imitate it, because novelty and peculiarity being its only merit, when it ceases to be new, it ceases to have value.

"A manner, therefore, being a defect, and every painter, however excellent, having a manner, it seems to follow, that all kinds of faults as well as beauties may be learned under the sanction of the greatest authority."

## Sect. V. *Of Colouring*.

Colouring, though a subject greatly inferior to many others which the painter must study, is yet of sufficient importance to employ a considerable share of his attention; and to excel in it, he must be well acquainted with that part of optics which has the nature of light and colours for its object. Light, however simple and uncompounded it may appear, is nevertheless made up, as it were, of several distinct substances; and the number, and even dose, of these ingredients, has been happily discovered by the moderns. Every undivided ray, let it be ever so fine, is a little bundle of red, orange, yellow, green, azure, indigo, and violet rays, which, while combined, are not to be distinguished one from another, and form that kind of light called *white*;

Colouring. *white*: so that white is not a colour *per se*, as the learned Da Vinci† (so far, it seems, the precursor of Newton) expressly affirms, but an assemblage of colours. Now, these colours, which compose light, although immutable in themselves, and endued with various qualities, are continually, however, separating from each other in their reflection from and passage through other substances, and thus become manifest to the eye. Grass, for example, reflects only green rays, or rather reflects green rays in greater number than it does those of any other colour; one kind of wine transmits red rays, and another yellowish rays: and from this kind of separation arises that variety of colours with which nature has diversified her various productions. Man, too, has contrived to separate the rays of light by making a portion of the sun's beams pass through a glass prism; for after passing through it, they appear divided into seven pure and primitive colours, placed in succession one by the other, like so many colours on a painter's pallet.

† *Trattato della Pittura*, c. 14.

Now, though Titian, Corregio, and Vandyke, have been excellent colourists, without knowing any thing of these physical subtleties, that is no reason why others should neglect them. For it cannot but be of great service to a painter to be well acquainted with the nature of what he is to imitate, and of those colours with which he is to give life and perfection to his designs; not to speak of the pleasure there is in being able to account truly and solidly for the various effects and appearances of light. From a due tempering, for example, and degrading, of the tints in a picture; from making colours partake of each other, according to the reflection of light from one object to another; there arises, in some measure, that sublime harmony which may be considered as the true music of the eye. And this harmony has its foundation in the genuine principles of optics. Now this could not happen in the system of those philosophers, who held, that colours did not originally exist in light, but were, on the contrary, nothing else than so many modifications which it underwent in being reflected from other substances, or in passing through them; thus subject to alterations without end, and every moment liable to perish. Were that the case, bodies could no more receive any hues one from another, nor this body partake of the colour of that, than scarlet, for example; because it has the power of changing into red all the rays of the sun or sky which immediately fall upon it, has the power of changing into red all the other rays reflected to it from a blue or any other colour in its neighbourhood. Whereas, allowing that colours are in their own nature immutable one into another, and that every body reflects, more or less, every sort of coloured rays, though those rays in the greatest number which are of the colour it exhibits, there must necessarily arise, in colours placed near one another, certain particular hues or temperaments of colour: nay, this influence of one colour upon another may be so far traced, that three or four bodies of different colours, and likewise the intenseness of the light falling upon each, being assigned, we may easily determine in what situations and how much they would tinge each other. We may thus, too, by the same principle of optics, account for several other things practised by painters; insomuch that a person, who has carefully observed natural effects with an eye directed by solid learning, shall be able to form general rules, where another can only distinguish particular cases.

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But after all, the pictures of the best colourists are, it is universally allowed, the books in which a young painter must chiefly look for the rules of colouring; that is, of that branch of painting which contributes so much to express the beauty of objects, and is so requisite to represent them as what they really are. Giorgio and Titian seem to have discovered circumstances in nature which others have entirely overlooked; and the last in particular has been happy enough to express them with a pencil as delicate as his eye was quick and piercing. In his works we behold that sweetness of colouring which is produced by union, that beauty which is consistent with truth; and all the insensible transmutations, all the soft transitions, in a word, all the pleasing modulations, of tints and colours. When a young painter has, by close application, acquired from Titian, whom he can never sufficiently dwell upon, that art which, of all painters, he has best contrived to hide, he would do well to turn to Bassano and Paolo, on account of the beauty, boldness, and elegance of their touches. That richness, softness, and freshness of colouring for which the Lombard school is so justly cried up, may likewise be of great service to him. Nor will he reap less benefit by studying the principles and practice of the Flemish school; which, chiefly by means of her varnishes, has contrived to give a most enchanting lustre and transparency to her colours.

But whatever pictures a young painter may choose to study the art of colouring upon, he must take great care that they be well preserved. There are very few pieces which have not suffered more or less by the length, not to say the injuries, of time; and perhaps that precious patina, which years alone can impart to paintings, is in some measure akin to that other kind which ages alone impart to medals; inasmuch as, by giving testimony to their antiquity, it renders them proportionably beautiful in the superstitious eyes of the learned. It must indeed be allowed, that if, on the one hand, this patina bestows, as it really does, an extraordinary degree of harmony upon the colours of a picture, and destroys, or at least greatly lessens, their original rawness, it, on the other hand, equally impairs the freshness and life of them. A piece seen many years after it has been painted, appears much as it would do, immediately after painting, behind a dull glass. It is no idle opinion, that Paolo Veronese, attentive above all things to the beauty of his colours, and what is called *strepito*, left entirely to time the care of harmonizing them perfectly, and (as we may say) mellowing them. But most of the old masters took that task upon themselves; and never exposed their works to the eyes of the public, until they had ripened and finished them with their own hands. And who can say whether the *Christ* of Moneta, or the *Nativity* of Bassano, have been more improved or injured (if we may so speak) by the touchings and retouchings of time, in the course of more than two centuries? It is indeed impossible to be determined. But the studious pupil may make himself ample amends for any injuries which his originals may have received from the hands of time, by turning to truth, and to Nature which never grows old,

Colouring. old, but constantly retains its primitive flower of youth, and was itself the model of the models before him. As soon, therefore, as a young painter has laid a proper foundation for good colouring, by studying the best masters, he should turn all his thoughts to truth and nature. And it would perhaps be well worth while to have, in the academies of painting, models for colouring as well as designing; that as from the one the pupils learn to give their due proportion to the several members and muscles, they may learn from the other to make their carnations rich and warm, and faithfully copy the different local hues which appear quite distinct in the different parts of a fine body. To illustrate still farther the use of such a model, let us suppose it placed in different lights; now in that of the sun, now in that of the sky, and now again in that of a lamp or candle; one time placed in the shade, and another in a reflected light. Hence the pupil may learn all the different effects of the complection in different circumstances, whether the livid, the lucid, or transparent; and, above all, that variety of tints and half tints, occasioned in the colour of the skin by the epidermis having the bones immediately under it in some places, and in others a greater or less number of blood-vessels or quantity of fat. An artist who had long studied such a model would run no risk of degrading the beauties of nature by any particularity of style, or of giving into that preposterous fulness and floridness of colour which is at present so much the taste. He would not feed his figures with roses, as an ancient painter of Greece shrewdly expressed it, but with good beef; a difference which the learned eye of a modern writer could perceive between the colouring of Barocci and that of Titian. To practise in that manner, is, according to a great master, no better than inuring one's self to the commission of blunders. What statues are in design, nature is in colouring; the fountain-head of that perfection to which every artist, ambitious to excel, should constantly aspire: and accordingly the Flemish painters, in consequence of their aiming solely to copy nature, are in colouring as excellent as they are wont to be aukward in designing. The best model for the tone of colours and the degradation of shades is furnished by means of the *camera-obscura*. See DIOPTRICS, Sect. 6th and 9th.

*Webb*, dial. 5.

## SECT. VI. *Of Drapery.*

DRAPERY is one of the most important branches of the whole art, and accordingly demands the greatest attention and study. It seldom happens that a painter has nothing but naked figures to represent; nay, his subjects generally consist of figures clothed from head to foot. Now the flowing of the folds in every garment depends chiefly upon the relief of the parts that lie under it. A certain author, we forget his name, observes, that as the inequalities of a surface are discoverable by the inequalities in the water that runs over it, so the posture and shape of the members must be discernible by the folds of the garment that covers them. Those idle windings and gatherings, with which some painters have affected to cover their figures, make the clothes made up of them look as if the body had fled from under them, and left nothing in its place but a heap of empty bubbles, fit emblems of the brain that conceived them. As from the trunk of a tree there issue here and there boughs of various forms, so from one mistress fold there always flow many lesser ones: and as it is on the quality of the tree that the elegance, compactness, or openness of its branches chiefly depends; it is, in like manner, by the quality of the stuff of which a garment is made, that the number, order, and size of its folds must be determined. To sum up all in two words, the drapery ought to be natural and easy, so as to show what stuff it is, and what parts it covers. It ought, as a certain author expresses it, to cover the body, as it were merely to show it.

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It was formerly the custom with some of our masters to draw all their figures naked, and then drape them; from the same principle that they first drew the skeletons of their figures, and afterwards covered them with muscles. And it was by proceeding in this manner that they attained to such a degree of truth in expressing the folds of their drapery, and the joints and direction of the principle members that lay under it, so as to exhibit in a most striking manner the attitude of the person to whom they belonged. That the ancient sculptors clothed their statues with equal truth and grace, appears from many of them that are still in being; particularly a Flora lately dug up in Rome, whose drapery is executed with so much judgment, and in so grand and rich a style, that it may vie with the finest of their naked statues, even with the Venus of Medicis. The statues of the ancients had so much beauty when naked, that they retained a great deal when clothed. But here it must be considered, that it was usual with them to suppose their originals clothed with wet garments, and of an extreme fineness and delicacy, that, by lying close to the parts, and in a manner clinging to them, they might the better show what these parts were. For this reason a painter is not to confine himself to the study of the ancient statues, lest he should contract a dry style, and even fall into the same faults with some great masters who, accustomed to drape with such light stuffs as fit close to the body, have afterwards made the coarsest lie in the same manner, so as plainly to exhibit the muscles underneath them. It is therefore proper to study nature herself, and those modern masters who have come nearest to her in this branch; such as Paolo Veronese, Andrea del Sarto, Rubens, and above all, Guido Reni. The flow of their drapery is soft and gentle; and the gatherings and plaits are so contrived, as not only not to hide the body, but to add grace and dignity to it. Their gold, silk, and woollen stuffs, are so distinguishable one from another, by the quality of their several lustres, and the peculiar light and shade belonging to each, but above all by the form and flow of their folds, that the age and sex of their figures are hardly more discoverable by their faces. Albert Durer is another great master in this branch, insomuch that Guido himself was not ashamed to study him. There are still extant several drawings made with the pen by this great man, in which he has copied whole figures from Albert, and scrupulously retained the flow of his drapery as far as his own peculiar style, less harsh and sharp, but more easy, and graceful, would allow. It may be said that he

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he made the same use of Albert that our modern writers ought to make of the best authors of the 13th century.

To drape a figure well, it is necessary that the folds be large and few in number; because large folds produce great masses of light and shadow, while small ones multiply the objects of view and distract the attention. But if the character of the drapery or kind of stuff require small folds, they should at least be distributed in groups, in such a manner that a great number of small folds shall be subordinate to an equal mass formed by a principal fold.

It is also proper to observe, that the colour of the drapery contributes to the harmony of the whole, and produces effects which the claro obscuro cannot do alone. At the same time, the principles of the claro-obscuro should preside over, or at least regulate, the art of drapery. If the folds of the stuff which cover the members exposed to the light are too strongly shaded, they will appear to enter into the members, and cut them.

Drapery contributes to the life, to the character, to the expression of the figures, provided all the movements of the folds announce the lively or more tranquil movement of those figures. The colour, and the kind of stuff, concur also to promote the general expression; brilliant or fine drapery cannot be properly introduced in a mournful subject, nor the opposite in a gay one.

The drapery must also agree with the age and character of the figures: And if nature in any instance is found to contradict those principles, it is because they relate to the ideal of the art; and it is this ideal which carries it to the greatest perfection.

Great attention is also necessary to the situation in which the figures are placed, and the actions about which they are employed. If they are in the act of ascending, a column of air weighs down the drapery; if, on the contrary, they are descending, the drapery is supported and spread out. The folds placed on every member, and the general play of the drapery, should indicate whether the figure is in action or about to be so; whether action be beginning or ending; and whether it be slow, or quick, or violent. All this is agreeable to nature; but it also partakes of the ideal, since nature never can be copied in such fluctuating situations. The practice of the Roman schools, first to draw after nature, and then to paint after the drawing, cannot be adopted by colourists; because nature, according to the kind of the stuffs, produces tones and lights, which give more perfection and truth to the work. Meanwhile Raphael, who followed this practice, enjoys the first reputation for giving play to his drapery, and disposing the folds in the best order. In this part he has even attained the height of ideal beauty. He is the greatest painter of drapery, as the Venetians are the greatest in painting stuffs.

Raphael, says Mengs, imitated at first his master Perugin's manner of drapery; and he brought this manner to perfection, by studying the works of Massaccio and of Bartholomew: but he departed entirely from the taste of the school in which he was educated when he had seen the works of the ancients. It was the basso-relievo of antiquity which pointed out to him the true flowing of drapery, and he was not backward to introduce it. He discovered, by attending to the principles of the ancients, that the naked is the principal part; that drapery is to be regarded altogether as an accessory, and that it is intended to cover, not to conceal; that it is employed from necessity, not caprice; that of consequence the clothes should not be so narrow as to constrain the members, nor so ample as to embarrass them; but that the artist should adapt them to the size and attitude of the figures intended to wear them.

He understood that the great folds should be placed at the large places of the body; and where the nature of the drapery required small folds, that it was necessary to give them a projection, which indicates a subordination to the principal parts.

He made his ample draperies without useless folds, and with bendings at the articulations. It was the form of the naked figure which pointed out to him the form of his folds, and on the great muscles he formed great masses. When any part required to be foreshortened, he covered it with the same number of folds as if it had been straight; but then he crowded them in proportion to the foreshortening.

He frequently discovered the border of his drapery, to show that his figures were not dressed in a simple sack. The form of the principal parts, and the specific weight of the air, were always the causes of his folds. It was easy to discover in his works, by the folds of his drapery, the attitude of the figure previous to the one in which it was placed; and whether, for example, the arm was extended or otherwise, immediately before the action. This was an expression which he had carefully studied on all occasions, because he found it in nature.

When the drapery was to cover the leg or arm but half, or in an imperfect manner, he made it cut obliquely the member which was partly to be covered. His folds were of a triangular form. The reason of this form is in nature; for all drapery has a tendency to enlarge itself and be extended; and as at the same time its own weight obliges it to fall back on itself, it is naturally formed into triangles.

He knew perfectly that the movements of the body and of its members are the causes of the actual situation of drapery, and of the formation of its folds. All his practice is nothing else but the unfolding and demonstrating of this theory; and drapery executed in any other manner must be in a false and vicious taste.

## Sect. VII. *Of Landscape and Architecture.*

When our young painter has made a sufficient progress in those principal branches of his art, the designing, perspective, colouring, and drapery of human figures, he should turn his thoughts to landscape and architecture: for, by studying them, he will render himself universal, and qualified to undertake any subject; so as not to resemble certain literati, who, though great masters in some articles, are mere children in every thing else.

The most eminent landscape painters are Poussin, Lorenese, and Titian.

Poussin was remarkable for his great diligence. His pieces are quite exotic and uncommon; being set off with buildings in a beautiful but singular style; and with

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with learned episodes, such as poets reciting their verses to the woods, and youths exercising themselves in the several gymnastic games of antiquity; by which it plainly appears, that he was more indebted for his subjects to the descriptions of Pausanias than to nature and truth.

Lorenese applied himself chiefly to express the various phenomena of light, especially those perceivable in the heavens. And thanks to the happy climate of Rome, where he studied and exercised his talents, he has left us the brightest skies, and the richest and most gloriously cloud-tipt horizons, that can be well conceived. Nay, the sun himself, which, like the Almighty, can be represented merely by his effects, has scarce escaped his daring and ambitious pencil.

Titian, the great confident of nature, is the Homer of landscape. His scenes have so much truth, so much variety, and such a bloom in them, that it is impossible to behold them, without wishing, as if they were real, to make an excursion into them. And perhaps the finest landscape that ever issued from mortal hands, is the back ground of his *Martyrdom of St Peter;* where, by the difference between the bodies and the leaves of his trees and the disposition of their branches, one immediately discovers the difference between the trees themselves; where the different soils are so well expressed, and so exquisitely clothed with their proper plants, that a botanist has much ado to keep his hands from them. See Part II. Sect. ii.

Paolo Veronese is in architecture what Titian is in landscape. To excel in landscape, we must, above all things, study nature. To excel in architecture, we must chiefly regard the finest works of art; such as the fronts of ancient edifices, and the fabrics of those moderns who have best studied and best copied antiquity. Next to Brunelleschi and Alberti, who were the first revivers of architecture, came Bramante, Giulio Romano, Sansovino, Sanmicheli, and lastly Palladio, whose works the young painter should above all the rest diligently study and imprint deeply on his mind. Nor is Vignola to be forgot: for some think he was a more scrupulous copier of antiquity, and more exact, than Palladio himself, insomuch that most people consider him as the first architect among the moderns. For our part, to speak of him, not as fame, but as truth seems to require, we cannot help thinking, that rather than break through the generality of the rules contrived by him to facilitate practice, he has in some instances deviated from the most beautiful proportions of the antique, and is rather barren in the distribution and disposition of certain members. Moreover, the extraordinary height of his pedestals and cornices hinders the column from showing in the orders designed and employed by him, as it does in those of Palladio. Amongst that great variety of proportions to be met with in ancient ruins, Palladio has been extremely happy in choosing the best. His profiles are well contrasted, yet easy. All the parts of his buildings hang well together. Grandeur, elegance, and beauty, walk hand in hand in them. In short, the very blemishes of Palladio, who was no slave to conveniency, and sometimes perhaps was too profuse in his decorations, are picturesque. And we may reasonably believe, that it was by following so great a master, whose works he had continually before his eyes, that Paolo Veronese formed that fine and masterly taste which enabled him to embellish his compositions with such beautiful structures.

The study of architecture cannot fail, in another respect, of being very useful to the young painter, inasmuch as it will bring him acquainted with the form of the temples, thermæ, basilics, theatres, and other buildings of the Greeks and Romans. Besides, from the basso-relievos with which it was customary to adorn these buildings, he may gather, with equal delight and profit, the nature of their sacrifices, arms, military ensign, and dress. The study of landscape, too, will render familiar to him the form of the various plants peculiar to each soil and climate, and such other things as serve to characterise the different regions of the earth. Thus by degrees he will learn what we call *costume*, one of the chief requisites in a painter; since by means of it he may express with great precision the time and place in which his scenes are laid.

Expression of the Passions.

## SECT. VIII. *Of the Expression of the Passions.*

That language which above all others a painter should carefully endeavour to learn, and from nature herself, is the language of the passions. Without it the finest works must appear lifeless and inanimate. It is not enough for a painter to be able to delineate the most exquisite forms, give them the most graceful attitudes, and compose them well together; it is not enough to dress them out with propriety, and in the most beautiful colours; it is not enough, in fine, by the powerful magic of light and shade, to make the canvas vanish. No; he must likewise know how to clothe his figures with grief, with joy, with fear, with anger; he must, in some sort, write on their faces what they think and what they feel; he must give them life and speech. It is indeed in this branch that painting truly soars, and in a manner rises superior to itself; it is in this branch she makes the spectator apprehend much more than what she expresses.

The means employed in her imitations by painting, are the circumscription of terms, the chiaro-scuro, and colours; all which appear solely calculated to strike the visual faculty. Notwithstanding which, she contrives to represent hard and soft, rough and smooth surfaces, which are objects of the touch: and this by means of certain tints, and a certain chiaro-scuro, which has a different book in marble, in the bark of trees, in downy and delicate substances. Nay, she contrives to express sound and motion, by means of light and shade, and certain particular configurations. In some landscapes of Diderich, we almost hear the water murmur, and see it tremble along the sides of the river and of the boats upon it. In the *Battle* of Burgogne, we are really apt to fancy that the trumpet sounds; and we see the horse, who has thrown his rider, scamper along the plain. But what is still more wonderful, painting, in virtue of her various colours and certain particular gestures, expresses even the sentiments and most hidden affections of the soul, and renders her visible, so as to make the eye not only touch and hear, but even kindle into passion and reason.

Many have written, and amongst the rest the famous Le Brun, on the various changes that, according to the various passions, happen in the muscles of the face, which is, as it were, the dumb tongue of the soul. They

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They observe, for example, that in fits of anger the face reddens, the muscles of the lips puff out, the eyes sparkle; and that, on the contrary, in fits of melancholy, the eyes grow motionless and dead, the face pale, and the lips sink in. It may be of service to a painter to read these and such other remarks; but it will be of infinitely more service to study them in nature itself, from which they have been borrowed, and which exhibits them in that lively manner which neither tongue nor pen can express.

Upon Le Brun's Treatise on the Passions, we have the following just, though severe, criticism by Winckleman. "Expression, though precarious in its nature (says he), has been reduced into a system, in a Treatise on the Passions by Charles le Brun, a work generally put into the hands of young artists. The plates which accompany this treatise do not only give to the face the affections of the soul in too high a tone, but there are many of the heads in which the passions are represented in an outrageous manner. He appears to give instructions in expression, as Diogenes gave examples of morality; I act like musicians, said that cynic, who give a high tone, in order to indicate a true one. But the fervour of youth has naturally more inclination to seize the extreme than the middle; and hence it is difficult for the young artist, in copying after Le Brun, to seize the true tone. Youth in general may be supposed to have that regard for the calm and moderate in the arts, which they have for the precepts of wisdom and virtue."

Other French writers have given instructions respecting the expression of the passions, equally exceptionable with those of Le Brun. All of them whom we have consulted make so many divisions and subdivisions of passions, that a philosopher cannot follow them in metaphysical theory, nor a painter exhibit their effects upon canvas. Nature therefore must be his guide, particularly in treating those very minute and almost imperceptible differences, by which, however, things very different from each other are often expressed. This is particularly the case with regard to the passions of laughing and crying; as in these, however contrary, the muscles of the face operate nearly in the same manner. As the famous Pietro de Cortona was one day finishing the face of a crying child in a representation of the Iron Age, with which he was adorning the floor called the *Hot-bath* in the royal palace of Pitti, Ferdinand II. who happened to be looking over him for his amusement, could not forbear expressing his approbation, by crying out, "Oh how well that child cries!" To whom the artist,—"Has your majesty a mind to see how easy it is to make children laugh? Behold, I'll prove it in an instant:" And taking up his pencil, by giving the contour of the mouth a concave turn downwards instead of the convex upwards which it before had, and with little or no alteration in any other part of the face, he made the child, who a little before seemed ready to burst its heart with crying, appear in equal danger of bursting its sides with immoderate laughter; and then, by restoring the altered features to their former position, he soon set the child a-crying again."

*Lectures of Philip Baldinucci in the Academy of La Crusca il Lystrato, &c.*

The different expressions of laughter and weeping are thus described by Le Brun. "The movements of laughter are expressed by the eye-brows elevated towards the middle of the eye, and lowered towards the sides of the nose; the eyes, almost shut, appear sometimes moistened with tears: the mouth, a little open, allows the teeth to be seen: the extremities of the mouth drawn back, make a dimple in the cheeks, which appear to be swelled: the nostrils are open: and the face becomes red. The changes which weeping occasions are equally visible. The eye-brow is lowered on the middle of the forehead; the eyes are almost shut, moistened, and lowered towards the sides of the cheeks: the nostrils are swelled, and the veins of the forehead very apparent; the mouth shut, by the lowness of its sides, occasions wrinkles in the cheeks; the under lip is turned down, and presses at the same time the upper lip: the whole countenance is wrinkled and becomes red; especially the eye-brows, the eyes, the nose, and the cheeks."

According to Leonardo da Vinci, the best masters that a painter can have recourse to in this branch are those dumb men who have found out the method of expressing their sentiments by the motion of their hands, eyes, eye-brows, and in short every other part of the body. If this advice be at all proper, such gestures must be imitated with great sobriety and moderation, lest they should appear too strong and exaggerated; and the piece should show nothing but pantomimes, when speaking figures alone are to be exhibited; and so become theatrical and second-hand, or, at best, look like the copy of a theatrical and second-hand nature.

The artist will reap greater benefit from studying such fine ancient heads as those of Mithridates, Seneca, Alexander dying, Cleopatra, Niobe, &c. and above all, from attentively observing such movements of nature as we daily meet with in the world. But let him chiefly consult his looking-glass, and study after his own face, what, in certain expressions, are the muscles, the lineaments, the tints, and the accidental circumstances which characterise the situation of the soul. It rarely happens that a model, which is affected with no sentiment, presents that to us which we ourselves feel, and which we are capable of expressing when we are our own model. Puget executed the legs of his Milo after his own; and many ingenious artists have had recourse to a similar expedient. In short, to be affected ourselves is the true secret of affecting the spectator.

We must not neglect, at the same time, to secure the fleeting characters which nature presents to us on a thousand occasions. We must distrust our memory, and all the resources which are not easily employed when we happen to stand in need of them. It is necessary to watch the circumstances from which we can derive any useful hint; to seize them when they present themselves; and to be careful never to lose, by an irreparable negligence, the fruit of a happy incident.

Let us also endeavour to possess the feeling of what we are to express; whether it be by forming the image of a thing absent as if it were present, or by being affected with the lively idea of a situation which we have either experienced, or with which we have seen another person remarkably affected. We must never forget, that all the terrible or agreeable, the violent or slight movements, are to be treated in a natural manner, and bear a relation to the age, condition,

tion, sex, and dignity of the person. Those gradations, which art varies according to the nature of the situation, and the character of men, compose the principal ingredients of discernment, knowledge, and taste. They have been the objects of attention and inquiry to the most eminent painters of every age; and they were of the last importance in assisting them to arrive at that degree of excellence to which they have carried expression.

We are told strange things of the ancient painters of Greece in regard to expression; especially of Aristides; who, in a picture of his, representing a woman wounded to death at a siege, with a child crawling to her breast, makes her appear afraid, lest the child, when she was dead, should, for want of milk, suck her blood. *A Medea murdering her children*, by Timomachus, was likewise much cried up, as the ingenious artist contrived to express, at once, in her countenance, both the fury that hurried her on to the commission of so great a crime, and the tenderness of a mother that seemed to with-hold her from it. Rubens attempted to express such a double effect in the face of Mary of Medicis, still in pain from her past labour, and at the same time full of joy at the birth of a Dauphin. And in the countenance of Sancta Polonia, painted by Tiepolo for St Anthony's church at Padua, one may clearly read a mixture of pain from the wound given her by the executioner, and of pleasure from the prospect of paradise opened to her by it.

Few, to say the truth, are the examples of strong expression afforded by the Venetian, Flemish, or Lombard schools. Deprived of that great happiness, the happiness of being able to contemplate, at leisure, the works of the ancients, the purest sources of perfection in point of design, expression, and character; and having nothing but nature constantly before their eyes; they made strength of colouring, blooming complections, and the grand effects of the chiaro-obscuro, their principal study: they aimed more at charming the sense than at captivating the understanding. The Venetians, in particular, seem to have placed their whole glory in setting off their pieces with all that rich variety of personages and dress, which their capital is continually receiving by means of its extensive commerce, and which attracts so much the eyes of all those who visit it. It is much to be doubted, if, in all the pictures of Paolo Veronese, there is to be found a bold and judicious expression, or one of those attitudes which, as Petrach expresses it, speak without words; unless, perhaps, it be that remarkable one in his *Marriage Feast of Cana of Galilee*. At one end of the table, and directly opposite to the bridegroom, whose eyes are fixed upon her, there appears a woman in red, holding up to him the skirt of her garment; as much as to say, we may suppose, that the wine miraculously produced was exactly of the colour with the stuff on her back. And in fact it is red wine we see in the cups and pitchers. But all this while the faces and attitudes of most of the company betray not the least sign of wonder at so extraordinary a miracle. They all, in a manner, appear intent upon nothing but eating, drinking, and making merry. Such, in general, is the style of the Venetian school. The Florentine, over which Michael Angelo presided, above all things curious of design, was most minutely and scrupulously exact in point of anatomy. On this she set her heart, and took singular pleasure in displaying it. Not only elegance of form, and nobleness of invention, but likewise strength of expression, triumph in the Roman school, nursed as it were amongst the works of the Greeks, and in the bosom of a city which had once been the seminary of learning and politeness. Here it was that Domenichino and Poussin, both great masters of expression, refined themselves, as appears more particularly by the *St Jerome* of the one, and the *Death of Germanicus*, and the *Slaughter of the Innocents*, by the other. Here it was that Raphael arose, the sovereign master of them all. One would imagine, that pictures, which are generally considered as the books of the ignorant, and of the ignorant only, he had undertaken to make the instructors even of the learned. One would imagine, that he intended, in some measure, to justify Quintilian*, who affirms, that painting has more power over us than all the arts of rhetoric. There is not, indeed, a single picture of Raphael's, from the study of which those who are curious in point of expression may not reap great benefit; particularly his *Martyrdom of St Felicitas*, his *Transfigurations*, his *Joseph explaining to Pharoah his dream*, a piece so highly rated by Poussin. His *School of Athens*, in the Vatican, is, to all intents and purposes, a school of expression. Among the many miracles of art with which this piece abounds, we shall single out that of the four boys attending on a mathematician, who, stooping to the ground with his compasses in his hand, is giving them the demonstration of a theorem. One of the boys, recollecting within himself, keeps back, with all the appearance of profound attention to the reasoning of the matter; another, by the briskness of his attitude, discovers a greater quickness of apprehension; while the third, who has already seized the conclusion, is endeavouring to beat it into the fourth, who, standing motionless, with open arms, a staring countenance, and an unspeakable air of stupidity in his looks, will never perhaps be able to make any thing of the matter. And it is probable from this very group that Albani, who studied Raphael so closely, drew the following precept of his: "That it behoves a painter to express more circumstances than one by every attitude; and so to employ his figures, that, by barely seeing what they are actually about, one may be able to guess, both what they have been already doing, and are next going to do." This is indeed a difficult precept; but it is only by a due observance of it that the eye and the mind can be made to hang in suspence on a painted piece of canvas. It is expression that a painter, ambitious to soar in his profession, must, above all things, labour to perfect himself in. It is the last goal of his art, as Socrates proves to Parrhasius†. It is in expression that dumb poetry consists, and what the prince of our poets calls a visible language.

* *Instit.* lib. xi. cap. 3.

† *Xenoph. Memorab.* lib. iii.

## Sect. IX. *Of Invention.*

As the operations of a general should all ultimately tend to battle and conquest, so should all the thoughts of a painter to perfect invention. Now, the studies which we have been hitherto recommending, will prove so many wings by which he may raise himself, as it were, from the ground, and soar on high, when

when desirous of trying his strength this way, and producing something from his own hand. Invention is the finding out probable things, not only such as are adapted to the subject in hand, but such, besides, as by their sublimity and beauty are most capable of exciting suitable sentiments in the spectator, and of making him, when they happen to be well executed, fancy that it is the subject itself in its greatest perfection, and not a mere representation of it, that he has before him. We do not say true things, but probable things; because probability or verisimilitude is, in fact, the truth of those arts which have the fancy for their object. It is, indeed, the business and duty of both naturalists and historians to draw objects as they find them, and represent them with all those imperfections and blemishes, to which, as individuals, they are subject. But an ideal painter, and such alone is a true painter, resembles the poet: instead of copying, he imitates: that is, he works with his fancy, and represents objects endued with all that perfection which belongs to the species, and may be conceived in the archetype.

"'Tis nature all, but nature methodis'd;"

says an eminent poet, speaking of poetry: And the same may be said of painting; it is nature methodized, and made perfect. Insomuch, that the circumstances of the action, exalted and sublimed to the highest degree of beauty and boldness they are susceptible of, may, though possible, have never happened exactly such as the painter fancies and thinks proper to represent them. Thus, the piety of Æneas, and the anger of Achilles, are things so perfect in their kind, as to be merely probable. And it is for this reason that poetry, which is only another word for invention, is more philosophical, more instructive, and more entertaining, than history.

Here it is proper to observe, what great advantages the ancient had over the modern painters. The history of the times they lived in, fraught with great and glorious events, was to them a rich mine of the most noble subjects, which, besides, often derived no small sublimity and pathos from the mythology upon which their religion was founded. So far were their gods from being immaterial, and placed at an infinite distance above their worshippers; so far was their religion from recommending humility, penance, and self-denial, that, on the contrary, it appeared calculated merely to flatter the senses, inflame the passions, and poison the fancy. By making the gods partake of our nature, and subjecting them to the same passions, it gave man hopes of being able to mix with those who, though greatly above him, resembled him, notwithstanding, in so many respects. Besides, those deities of theirs were in a manner visible, and to be met at every step. The sea was crowded with Tritons and Nereids, the rivers with Naiads, and the mountains with Dryads. The woods swarmed with Fauns and Nymphs, who, in these obscure retreats, sought an asylum for their stolen embraces. The most potent empires, the most noble families, the most celebrated heroes, all derived their pedigree from the greater divinities. Nay, gods interested themselves in all the concerns of mankind. Apollo, the god of long arrows, stood by the side of Hector in the fields of Troy, and inspired him with new strength and courage to batter down the walls and burn the ships of the Greeks. These, on the other hand, were led on to the fight and animated by Minerva, preceded by Terror, and followed by Death. Jove nods, his divine locks shake on his immortal head; Olympus trembles. With that countenance, which allays the tempest, and restores serenity to the heavens, he gathers kisses from the mouth of Venus, the delight of gods and of men. Among the ancients, every thing sported with the fancy; and in those works which depend entirely on the imagination, some of our greatest masters have thought they could not do better than borrow from the Pagans, if we may be allowed to say it, their pictures of Tartarus, in order to render their own drawings of hell more striking.

After all, there have not been wanting able inventors in painting among the moderns. Michael Angelo, notwithstanding the depth and boldness of his own fancy, is not ashamed in some of his compositions, to *Dantize*; as Phidias and Apelles may be said formerly to have *Homerized*. Raphael, too, tutored by the Greeks, has found means, like Virgil, to extract the quintessence of truth; has seasoned his works with grace and nobleness, and exalted nature, in a manner, above herself, by giving her an aspect more beautiful, more animating, and more sublime, than she is in reality accustomed to wear. In point of invention, Domenichino and Hannibal Caracci come very near Raphael, especially in the pieces painted by them in Rome; nor does Poussin fall very short of him in some of his pictures, particularly in his *Esther before Ahasuerus*, and his *Death of Germanicus*, the richest jewel belonging to the Barberine family. Of all the painters who have acquired any extraordinary degree of reputation, no one studied less to set off his pieces by bold and beautiful circumstances, or was more a stranger to what is called *poetical perfection*, than Jacopo Bassano. Among the numberless instances we could produce of his carelessness this way, let it suffice to mention a *Preaching of St Paul* painted by him in a place, near that of his birth, called *Marostego*. Instead of representing the apostle full of a divine enthusiasm, as Raphael has done, and thundering against the superstitions of the heathen in an assembly of Athenians; instead of exhibiting one of his auditors struck to the quick, another persuaded, a third inflamed; he makes him hold forth, in a village of the Venetian state, to a parcel of poor peasants and their wives, who take not the least notice of him; the women especially, who seem to mind nothing but the country labours in which he had found them employed.

With regard to invention, painting and poetry resemble each other so much in many other respects, besides that of combining in every action all the beauty and elegance it will admit, that they well deserve the name of *sister arts*. They differ, however, in one point, and that too of no small importance. It is this. The poet, in the representation of his story, relates what has already happened, prepares that which is still to come, and so proceeds, step by step, through all the circumstances of the action; and, to produce the greater effect on his hearers, avails himself of the succession of time and place. The painter, on the contrary, deprived of such helps, must be content to depend

Invention. pend upon one single moment. But what a moment! A moment, in which he may conjure up, at once, to the eyes of the spectator, a thousand objects; a moment, teeming with the most beautiful circumstances that can attend the action; a moment, equivalent to the successive labours of the poet. This the works of the greatest masters, which are everywhere to be seen, sufficiently evince: among others, the *St Paul at Lystra*, by Raphael, whom it is impossible not to praise as often as this picture is mentioned. In order to give the spectator a thorough insight into the subject of this piece, the painter has placed, in the front of it, the cripple, already restored to his limbs by the apostle, fired with gratitude towards his benefactor, and exciting his countrymen to yield him all kinds of honour. Round the cripple are some figures lifting up the skirts of his coat, in order to look at the legs reduced to their proper shape, and acknowledging by gestures full of astonishment the reality of the miracle; an invention, says a certain author, a professed admirer of antiquity, which might have been proposed as an example in the happiest age of Greece.

*Webb*, dia. 7.

We have another shining instance of the power of painting to introduce a great variety of objects on the scene at the same time, and of the advantage it has in this respect over poetry, in a drawing by the celebrated La Fage. This drawing represents the descent of Æneas into hell. The field is the dark caverns of Pluto's kingdom, through the middle of which creeps slowly the muddy and melancholy Acheron. Nearly in the centre of the piece appears Æneas with the golden bough in his hand, and with an air of astonishment at what he sees. The Sybil, who accompanies him, is answering the questions which he asks her. The personage there is the ferryman of the pitchy lake, by which even the gods themselves are afraid to swear. Those who, crowding in to the banks of the river, numberless as the leaves shaken off the trees by autumnal blasts, express, with outstretched hands, an impatience to be ferried to the opposite shore, are the unhappy manes, who, for want of burial, are unqualified for that happiness. Charon, accordingly, is crying out to them, and with his lifted-up oar driving them from his boat, which has already taken in a number of those who had been honoured with the accustomed funeral rites. Behind Æneas and the Sybil we discover a confused group of wretched souls, lamenting bitterly their misfortune in being denied a passage; two of them wrapped up in their clothes; and, in a fit of despair, sunk upon a rock. Upon the first lines of the piece stands a third group of uninhumed shades. Leucaspes, Orontes, and, in the midst of them, the good old Palinurus, formerly master and pilot of the hero's own vessel, who with joined hands most earnestly desires to be taken along with him into the boat, that, after death, at least, he may find some repose, and his dead body no longer remain the sport of winds and waves. Thus, what we see scattered up and down in many verses by Virgil, is here, as it were, gathered into a focus, and concentered by the ingenious pencil of the painter, so as to form a subject well worthy of being exposed, in more shapes than one, to the eyes of the public.

When a painter takes a subject in hand, be it historical, be it fabulous, he should carefully peruse the books which treat of it, imprint well on his mind all the circumstances that attend it, the persons concerned in it, and the passions with which they must have been severally animated; not omitting the particulars of time and place. His next business is to create it, as it were, anew, observing the rules already laid down for that purpose: From what is true, choosing that which is most striking; and clothing his subject with such accessory circumstances and actions, as may render it more conspicuous, pathetic, and noble, and best display the powers of the inventive faculty. But, in doing this, great discretion is requisite; for, let his imagination grow ever so warm, his hand is never to execute any thing that is not fully approved by his judgement. Nothing low or vulgar should appear in a lofty and noble argument; a fault, of which some of the greatest masters, even Lampieri and Poussin, have been now and then guilty.

The action must be one, the place one, the time one. We need not say any thing of those painters, who, like the writers of the Chinese and Spanish theatre, cram a variety of actions together, and so give us, at once, the whole life of a man. Such blunders, it is presumed, are too gross to be feared at present. The politeness and learning of the age seem to demand considerations of a more refined nature; such as, that the episodes introduced in the drama of a picture, the better to fill and adorn it, should be not only beautiful in themselves, but indispensably requisite. The games celebrated at the tomb of Anchises, in Sicily, have a greater variety in them, and more sources of delight, than those that had been before celebrated at the tomb of Patroclus under the walls of Troy. The arms forged by Vulcan for Æneas, if not better tempered, are at least better engraved, than those which the same god had forged several ages before for Achilles. Nevertheless, in the eyes of judges, both the games and the arms of Homer are more pleasing than those of Virgil, because the former are more necessary in the Iliad than the latter in the Æneid. Every part should agree with, and have a relation to, the whole. Unity should reign even in variety; for in this beauty consists. This is a fundamental maxim in all the arts whose object it is to imitate the works of nature.

Pictures often borrow no small grace and beauty from the fictions of poetry. Albani has left us, in several of his works, sufficient proofs of the great share the belles lettres had in refining his taste. But Raphael, above all others, may in this branch too be considered as a guide and master. To give but one instance out of many; what a beautiful thought was it to represent the river himself, in a *Passage of Jordan*, supporting his waters with his own hands, in order to open a way to the army of the Israelites! Nor has he displayed less judgment in reviving, in his designs engraved by Agostino of Venice, the little loves of Aëtius playing with the arms of Alexander, conquered by the beauty of Roxana.

Among the ancients, Apelles and Parrhasius were those who distinguished themselves most in allegorical subjects, in which the inventive faculty shows itself to the greatest advantage; the first by his picture of *Calumny* *, the second by that of the *Genius of the Athenians* †. The ancient painter called *Galaton* gave likewise

* See *Lucian* upon Calumny; and *Carlo Dati*, in the *Life of Apelles*, note 20.

† *C. Plinii Nat. Hist.* lib. xxxv. c. 10.

Invention. likewise a fine proof of his genius in this branch, by representing a great number of poets greedily quenching their thirst in the waters gushing from the mouth of the sublime Homer. And to this allegory, according to Guigni, Pliny* has an eye, when he calls that prince of poets the *fountain of wits*. But it is, after all, no way surprising that we should often meet such fine flights of fancy in the ancient artists. They were not guided in their works by a blind practice: they were men of polite education; conversant with the letters of the age in which they lived; and the companions rather than the servants of the great men who employed them. The finest allegorical painter among the moderns was Rubens; and he was accordingly much celebrated for it. The best critics, however, find fault with his uniting in the Luxemberg gallery, the queen-mother, in council, with two cardinals and Mercury. Nor is there less impropriety in his making Tritons and Nereids, in another piece of the same gallery, swim to the queen's vessel through the galleys of the knights of St Stephen. Such freedoms are equally disgusting with the prophecies of Sannazaro's Proteus, concerning the mystery of the incarnation, or the Indian kings of Camoens, reasoning with the Portuguese on the adventures of Ulysses.

* *Plinii Nat. Hist.* lib. xvii. cap. 5.

*Webb*, dial. 4.

*Polym.* dial. 18.

The best modern performances in picturesque allegory are certainly those of Poussin; who availed himself, with great discretion and judgment, of the vast treasures with which, by a close study of the ancients, he had enriched his memory. On the other hand, Le Brun, his countryman, has been very unhappy this way. Ambitious to have every thing his own, instead of allegories, he has filled the gallery of Versailles with enigmas and riddles, of which none but himself was qualified to be the Œdipus. Allegory must be ingenious, it is true; but then it must be equally perspicuous; for which reason, a painter should avoid all vague and indeterminate allusions, and likewise those to history and heathen mythology, which are too abstruse to be understood by the generality of spectators. The best way, perhaps, to symbolize moral and abstract things, is to represent particular events: as Carracci did, by advice of Monsignore Agucchi, in the Farnesian palace. For example, what can better express a hero's love towards his country, than the virtuous Decious consecrating himself boldly to the infernal gods, in order to secure victory to his countrymen over their enemies? What finer emblems can we desire of emulation, and an insatiable thirst for glory, than Julius Cæsar weeping before the statue of Alexander in the temple of Hercules at Gades? of the inconstancy of fortune, than Marius sitting on the ruins of Carthage, and receiving, instead of the acclamations of an army joyfully saluting him imperator, orders from a lictor of Sixtilius to quit Africa? of indiscretion, than Candaules, who, by showing the naked beauties of his wife to his friend Giges, kindled a passion that soon made him repent his folly? Such representations as these require no comment; they carry their explanations along with them. Besides, supposing, and it is the worst we can suppose, that the painter's aim in them should happen not to be understood, his piece would still give delight. It is thus that the fables of Ariosto prove so entertaining, even to those who understand nothing of the moral couched under them; and likewise the Æneis, though all do not comprehend the allusions and double intent of the poet.

See *Belori's Life of Carracci.*

Disposition.

## Sect. X. *Of Disposition.*

So much for invention. *Disposition*, which may be considered as a branch of invention, consists in the proper stationing of what the inventive faculty has imagined, so as to express the subject in the most lively manner. The chief merit of disposition may be said to consist in that disorder, which, wearing the appearance of mere chance, is in fact the most studied effect of art. A painter, therefore, is equally to avoid the dryness of those ancients who always planted their figures like so many couples in a procession, and the affectation of those moderns who jumble them together as if they were met merely to fight and squabble. In this branch Raphael was happy enough to choose the just medium, and attain perfection. The disposition of his figures is always exactly such as the subject requires. In the *Battle of Constantine*, they are confusedly clustered with as much art, as they are regularly marshalled in *Christ's commitment of the keys to St Peter*, and constituting him prince of the apostles.

Let the inferior figures of a piece be placed as they will, the principle figure should strike the eye most, and stand out, as it were, from among the rest. This may be effected various ways, as by placing it on the foremost lines, or in some other conspicuous part of the piece; by exhibiting it, in a manner, by itself; by making the principal light fall upon it; by giving it the most resplendant drapery; or, indeed, by several of these methods, nay, by all of them together. For, being the hero of the picturesque fable, it is but just that it should draw the eye to itself, and lord it, as it were, over all the other objects.

According to Leon Batista Alberti, painters should follow the example of comic writers, who compose their fable of as few persons as possible. For, in fact, a crowded picture is apt to give as much pain to the spectator, as a crowded road to the traveller.

Some subjects, it must be granted, require a number, nay, a nation, as it were, of figures. On these occasions, it depends entirely on the skill of the painter to dispose of them in such a manner, that the principal ones may always make the principal appearance; and contrive matters so that the piece be not overcrowded, or want convenient rests and pauses. He must, in a word, take care that his piece be full, but not charged. In this respect, the *Battles of Alexander* by Le Brun are master-pieces which can never be sufficiently studied; whereas nothing, on the other hand, can be more unhappy than the famous *Paradise* of Tintoret, which covers one entire side of the great council-chamber at Venice. It appears no better than a confused heap of figures, a swarm, a cloud, a chaos, which pains and fatigues the eye. What a pity it is that he did not dispose this subject after a model of his own, now in the gallery of Bevilacqua at Verona! In this last the several choirs of martyrs, virgins, bishops, and other saints, are judiciously thrown into so many clusters, parted here and there by a fine fleece of clouds, so as to exhibit the innumerable host of heaven

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ven drawn up in a way that makes a most agreeable and glorious appearance There goes a story, to our purpose, of a celebrated master, who in a drawing of the Universal Deluge, the better to express the immensity of the waters that covered the earth, left a corner of his paper without figures. Being asked, if he did not intend to fill it up; No, said he; do not you see that my leaving it empty is what precisely constitutes the picture?

The reason for breaking a composition into several groups is, that the eye, passing freely from one object to another, may the better comprehend the whole. But the painter is not to stop here; for these groups are, besides, to be so artfully put together, as to form rich clusters, give the whole composition a singular air of grandeur, and afford the spectator an opportunity of discerning the piece at a distance, and taking the whole in, as it were, at a single glance. These effects are greatly promoted by a due regard to the nature of colours, so as not to place together those which are apt to pain by their opposition, or distract by their variety. They should be so judiciously disposed as to temper and qualify each other.

A proper use of the chiaro-scuro is likewise of great service on this occasion. The groups are easily parted, and the whole picture acquires a grand effect, by introducing some strong falls of shade, and, above all, one principal beam of light. This method has been followed with great success by Rembrandt in a famous picture of his, representing the Virgin at the foot of the cross on mount Calvary; the principal light darting upon her through a break of the clouds, while the rest of the figures about her stand more or less in the shade. Tintoret, too, acquired great reputation, as well by that briskness with which he enlivened his figures, as by his masterly manner of shading them; and Polidoro de Caravaggio, though he scarce painted any thing but basso-relievos, was particularly famous for introducing with great skill the effects of the chiaro-scuro, a thing first attempted by Mantegna in his *Triumph of Julius Cæsar*. It is by this means that his compositions appear so strikingly divided into different groups, and, among their other perfections, afford so much delight through the beautiful disposition that reigns in them.

In like manner, a painter, by the help of perspective, especially that called *ærial*, the opposition of local colours, and other contrivances which he may expect to hit upon by studying nature, and those who have best studied her before him, will be able not only to part his groups, but make them appear at different distances, so as to leave sufficient passages between them.

But the greatest caution is to be used in the pursuit of the methods here laid down; especially in the management of the chiaro-scuro, that the effects attributed to light and shade, and to their various concomitants, may not run counter to truth and experience. This is a capital point. For this purpose, a painter would do well to make, in little figures, as Tintoret and Poussin used to do, a model of the subject that he intends to represent, and then illuminate it by lamp or candle-light. By this means he may come to know with certainty, if the chiaro-scuro, which he has formed in his mind, does not clash with the reason of things. By varying the height and direction of his light, he may easily discover such accidental effects as are most likely to recommend his performance, and so establish a proper system for the illuminating it. Nor will he afterwards find it a difficult matter to modify the quality of his shades, by softening or strengthening them, according to the situation of his scene, and the quality of the light falling upon it. If it should happen to be a candle or lamp-light scene, he would then have nothing to do but consider his model well, and faithfully copy it.

In the next place, to turn a group elegantly, the best pattern is that of a bunch of grapes adopted by Titian. As, of the many grains that compose a bunch of grapes, some are struck directly by the light, and those opposite to them are in the shade, whilst the intermediate ones partake of both light and shade in a greater or less degree; so, according to Titian, the figures of a group should be so disposed, that, by the union of the chiaro-scuro, several things may appear as it were but one thing. And in fact it is only from his having pursued this method, that we can account for the very grand effect of his pieces this way, in which it is impossible to study him too much.

The mannerists, who do not follow nature in the track of the masters just mentioned, are apt to commit many faults. The reason of their figures casting their shades in this or that manner seldom appears in the picture, or at least does not appear sufficiently probable. They are, besides, wont to trespass all bounds in splashing their pieces with light, that is, in enlivening those parts which we usually term the deafs of a picture. This method, no doubt, has sometimes a very fine effect; but it is, however, to be used with no small discretion, as otherwise the whole loses that union, that pause, that majestic silence, as Carracci used to call it, which affords so much pleasure. The eye is not less hurt by many lights scattered here and there over a picture, than the ear is by the confused noise of different persons speaking all together in an assembly.

*Hogarth's Analysis of Beauty.*

Guido Reni, who has imparted to his paintings that gaiety and splendor in which he lived, seems enamoured with a bright and open light; whereas Michael Angelo de Caravagio, who was of a sullen and savage disposition, appears fondest of a gloomy and clouded sky: so that neither of them were qualified to handle indifferently all objects. The chiaro-scuro may likewise prove of great service to a painter in giving his composition a grand effect; but, nevertheless, the light he chooses must be adapted to the situation of the scene where the action is laid: nor would he be less faulty, who in a grotto or cavern, where the light entered by a chink, should make his shades soft and tender, than he who should represent them strong and bold in an open sky-light.

But this is by no means the only fault which mannerists are apt to be guilty of in historical pieces, and particularly in the disposition of their figures. To say nothing of their favourite group of a woman lying on the ground with one child at her breast, and another playing about her, and the like, which they generally place on the first lines of their pieces; nor of those half-figures in the back ground peeping out from the hollows contrived for them: they make a common practice

Diſpoſition.

tice of mixing naked with clothed figures; old men with young; placing one figure with its face towards you, and another with its back; they contraſt violent motions with languid attitudes, and ſeem to aim at oppoſition in every thing; whereas oppoſitions never pleaſe, but when they ariſe naturally from the ſubject, like antitheſes in a diſcourſe.

As to foreſhortened figures, too much affectation in uſing or avoiding them is equally blameable. The attitudes had better be compoſed than otherwiſe. It very ſeldom happens that there is any occaſion for making them ſo impetuous as to be in danger of loſing their equilibrium; a thing too much practiſed by ſome painters.

In regard to drapery, equal care ſhould be taken to avoid that poverty, which makes ſome maſters look as if, through mere penury, they grudged clothes to their figures; and that profuſion which Albani imputed to Guido, ſaying, that he was rather a tailor than a painter. The ornaments of dreſs ſhould be uſed with great ſobriety; and it will not be amiſs to remember what was once ſaid to an ancient painter: "I pity you greatly; unable to make Helen handſome, you have taken care to make her fine."

Let the whole, in a word, and all the different parts of the diſpoſition, poſſeſs probability, grace, coſtume, and the particular character of what is to be repreſented. Let nothing look like uniformity of manner; which does not appear leſs in the compoſition than it does in colouring, drapery, and deſign; and is, as it were, that kind of accent, by which painters may be as readily diſtinguiſhed as foreigners are, by pronouncing in the ſame manner all the different languages they happen to be acquainted with.

## SECT. XI. *Of Illuſion.*

AMONG painters, and the writers on painting, there is one maxim univerſally admitted and continually inculcated; it is, that *nature ought to be imitated*, and objects are ſaid to be repreſented naturally, when they have ſuch relief that they may ſeem real. If we inquire to what degree painting may carry this illuſion, we ſhall find that it deceives the eye, and obliges the ſpectator to employ the touch in mouldings and in baſſo-relievos where they are a little projected; but that it is weakened and the effect partly deſtroyed where the projection is one or two feet. It is poſſible alſo to make it in the higheſt degree complete in pictures of flowers, fruits, and other repreſentations of ſtill life, provided they be ſeen in a certain point of view, and at a conſiderable diſtance; but there is no example of a picture containing a number of figures, and placed in a proper light, being miſtaken for real life. We are told, indeed, of a buſt of an abbé painted by Charles Coypel, which, placed in a certain direction behind a table, and in a certain light, deceived ſeveral perſons ſo completely as to induce them to ſalute it: but, without admitting any thing very extraordinary in the projection or illuſion of this painting, it is evident, from the circumſtances attending the relation, that the deception aroſe from ſurpriſe and inattention, which might happen to a production of an inferior artiſt. And hence we may conclude that it is vain to pretend to perfect the illuſion, eſpecially in pictures conſiſting of a number of figures, and with conſiderable diſtances ſuppoſed between them.

Illuſion.

Among the obſtacles which are oppoſed to the perfection of this branch of the art, we ſhall chiefly attend to thoſe which naturally proceed from our habits of thinking and judging on all occaſions. Theſe, together with the experience we daily have of light on all kinds of ſurfaces, and of all colours, are ſufficient to demonſtrate the want of reality in the mere repreſentation of any ſcenes.

It has been elſewhere ſhown, that diſtance, figure, and magnitude, are not naturally objects of perception by the ſenſe of ſight; that we judge of theſe things by the eye only, in conſequence of aſſociations early formed between the perceptions of touch and the correſponding impreſſions on the retina and optic nerve by the rays of light; and that a painter makes his picture reſemble the original, merely by laying his colours on a plain ſurface in ſuch a manner, as that they reflect the ſame rays of light with the convex or concave original, when the ſpectator ſtands at the proper diſtance (ſee METAPHYSICS, n° 49, 50, 51, 52, and 95). But if this be admitted, illuſion in painting can never be made perfect, on account of the inevitable falſity of the ſhades which mark the moſt diſtant parts of the picture. The painter can only imitate thoſe ſhades by obſcure colours, laid on a plane ſurface, and ſuſceptible of reflecting the light with a degree of force relative to the real diſtance. Now our eyes give us the true plane of this ſurface, oppoſed to the idea of deepening which the painter wiſhes to produce, a contrariety which prevents the deception. On this account, the faults found in the works of the greateſt maſters, with regard to the effects produced by the whole, moſt frequently relate to their manner of ſhading, which is ſufficient to prove, that the want of illuſion in painting depends chiefly on the imperfection of the ſhades.

This defect, though it cannot be wholly avoided, may yet be rendered leſs perceptible. There has yet, indeed, been no painter able to imitate ſhadow, nor is it probable that any one will ever perfectly accompliſh his taſk. Shadow in nature is not a body, but the privation of light, which deſtroys colours in a greater or leſs degree, in proportion as it is more or leſs complete. Now the painter can only imitate this privation and real darkneſs, by colours which muſt from their very nature be capable of reflecting light.—The colours may be more or leſs obſcure, but they preſerve always ſomething which gives a mixture of reflection. To carry the imitation of ſhadow to the higheſt degree of perfection, it would be neceſſary to apply a colour capable of darkening all others, more or leſs as there ſhould be occaſion, and which might have no viſible trace of its exiſtence, that is, no one part of it which reflected one coloured ray more ſtrongly than another. Perhaps this kind of negative colour might be found in practice to be of ſervice to the art; but it would not render the ſurface totally inviſible, for it would be neceſſary, farther, that it ſhould have the property of not reflecting a ſingle ray of light when expoſed to it; which is altogether impoſſible, as there is no colour or body in nature without reflection in ſuch a ſituation.

We ſhall be further convinced of the impoſſibility of

of painting shadow, if we attend to the pictures of the greatest masters, with regard to the imitation of truth. Every part, when taken by itself, connected with light, or with demitints, presents a perfect imitation. Even the different degrees of light or the objects are sufficiently exact; but notwithstanding this assemblage of circumstances corresponding with truth, and of which the result should be perfect *illusion*, yet in considering the whole, we are never so completely deceived, as to take a picture for a reality; from which we may conclude, that the want of illusion proceeds almost entirely from the imperfection of shading.

Illusion then, in the strictest sense, cannot exist in painting; but there is another kind of illusion, perhaps improperly so called, which is one of the principal parts of the art, and worthy of the greatest attention: It is, that the picture shall resemble truth to such a degree by the justness of its forms, by the combination of colours, and by all its general effects, that the image shall give all the pleasure to be expected from the imitation of truth. This is not illusion in the proper sense of the word, since it exists as well in pictures on a small scale as in those of equal dimensions with the original; but it is that true imitation of which painting is susceptible, even in pictures containing any number of figures at any reasonable distance from each other.

But it remains to be considered whether the imitation of truth, taken by itself, be the highest [illegible] perfection in painting. It is generally granted [illegible] the greatest beauty is that which not only [illegible] first view, but on the nearest and most [illegible] mination. But if illusion, such as we have defined it, were the sole merit of the [illegible] would follow, that the person who was least [illegible] with its beauties would experience the same [illegible] he who had studied them most. Farther, in examining the works of the greatest masters, it is easy to perceive, that it is not their illusion which has excited the attention and admiration of the critic. Even the works of the divine Raphael do not deceive the eye in any point of view more completely than those of an ordinary painter. Raphael, pure in his character and design, is, without doubt, very deficient in this part of the art. Meanwhile the grandeur of his ideas, [illegible] and the choice of his forms; the beauty of his [illegible] wherein one does not admire simply the imitation of any known truth; his ingenious and noble manner in drapery, which yet does not resemble any known stuff, or the garb of any nation; in short, all his beauties are superior to the simple imitation of truth, and contradict the sentiment of the greatest pleasure arising from illusion.

If we pass to those who have pursued colouring with the greatest success, we shall find them, doubtless, approach nearer to illusion than those who have neglected it; and it is also a fact, that their works have been more universally admired.

At the same time it is not the illusion occasioned by colours which has altogether excited this admiration. The exquisite demitints and the freshness of Correggio and Titian, which excel the ordinary beauties of nature, and even imitate her most perfect productions, may perhaps not be considered as destroying illusion; but it is no less a fact, that weaker and less precious colouring would carry it to greater perfection. Besides, this large, easy, and exquisite, manner of painting, this harmony, of which they have given us the best examples, are owing to qualities in them much more excellent than what would be sufficient to produce the simple imitation of truth. Guido, Cortona, and some others, appear to approach nearer to illusion. But even those masters prove by their works, that the most estimable beauties in painting do not all tend to this branch of the art; for notwithstanding the high character which they have gained, they are much inferior to Raphael, Corregio, and Titian, although the first failed in colouring and in the knowledge of the claro-obscuro, the second in point of correctness, and the third in the choice of noble subjects.

From this we may conclude, that the nearest resemblance to truth is not the sole object in painting; that it requires a superior degree of elevation by the art of adding beauty and perfection to the most exact resemblance; and that it is this art which distinguishes and characterizes extraordinary men.

If we run over the great branches of painting, we shall find a number of essential beauties different from those which are capable of carrying illusion to the greatest possible height. In composition, we principally admire the [illegible] of genius, the choice of picturesque and graceful attitudes, the ingenious combination of groups, whether in uniting the light and [illegible] to obtain the greatest effect, or in dis[illegible] in such a manner as to make no part [illegible]; and finally, that kind of practical talent by which the mind takes possession of nature, and forces it to produce all the beauties of which the art is susceptible. In this enumeration of particulars it is easy to perceive that the beauties of composition are very distant from those of illusion.

To obtain illusion in design, there is no occasion for correctness nor taste beyond what is perceived in nature by the most ignorant spectator. And with regard to colouring, that is not always most admired which is most natural. What departs widely from truth, is not of consequence beautiful, but many qualities are required besides the simple imitation of truth. Freshness, ease, and transparency in certain tones, are deemed absolutely requisite; and the most esteemed colourists have carried their beauties in all these respects beyond what they have seen in nature. If some tones in the fleshy parts have approached towards vermilion, to a light blue, or a silver-grey, they have made them more apparent; not only to point them out to the spectator, but to show their knowledge in the discovery and their art in painting them. This would have been going beyond the limits of perfection, if these had consisted in simple illusion.

The opposition of colour, of light, and of shade, would have been in this case also superfluous; for nature is always true, without any pointed attempt to make her more engaging. The suppression of certain lights, which truth would require, and which art extinguishes, in order to augment the harmony of effect, would be also worthy of censure, whatever pleasure would result from it.

Finally,

Finally, one of the greatest beauties of the art, namely the peculiar manner of a great master, has no relation to illusion. This is not even founded in nature, but depends on the genius or singularity of the artist. It is this manner which distinguishes the original of a great master from the most exact copy; and which characterizes the talents of the artists so well, that the smallest part of the picture, and even the least interesting, is sufficient to discover the painter. The distinction between the beautiful and illusive in painting has made Sir Joshua Reynolds, in express terms, recommend a perfection superior to the imitation of nature. "The principle now laid down (says he), that the perfection of the art does not consist in mere imitation, is far from being new or singular. It is, indeed, supported by the general opinion of the enlightened part of mankind. The poets, orators, and rhetoricians of antiquity, are continually enforcing this position, that all the arts receive their perfection from an ideal beauty, superior to what is to be found in individual nature. They are ever referring to the practice of the painters and sculptors of their times, particularly Phidias the favourite artist of antiquity, to illustrate their assertions. As if they could not sufficiently express their admiration of his genius by what they knew, they have recourse to poetical enthusiasm. They call it inspiration; a gift from heaven. The artist is supposed to have ascended the celestial regions to furnish his mind with this perfect idea of beauty. 'He (says Proclus) who takes for his model such forms as nature produces, and confines himself to an exact imitation of them, will never attain to what is perfectly beautiful. For the works of nature are full of disproportion, and fall short of the true standard of beauty. So that Phidias, when he formed his Jupiter, did not copy any object ever presented to his sight; but contemplated only that image which he had conceived in his mind from Homer's description.'

"It is not easy to define in what this great style consists, nor to describe by words the proper means of acquiring it, if the mind of the student should be at all capable of such an acquisition. Could we teach taste or genius by rules, they would be no longer taste and genius. But though there neither are nor can be any precise invariable rules for the exercise or the acquisition of these great qualities, yet we may truly say that they always operate in proportion to our attention in observing the works of nature, to our skill in selecting, and to our care in digesting, methodising, and comparing our observations. There are many beauties in our art that seem at first to lie without the reach of precept, and yet may easily be reduced to practical principles. Experience is all in all; but it is not every one that profits by experience; and most people err not so much from want of capacity to find their object, as from not knowing what object to pursue. This great ideal perfection and beauty are not to be sought in the heavens, but upon the earth. They are about us, and upon every side of us: But the power of discovering what is deformed in nature, or, in other words, what is particular or uncommon, can be acquired only by experience; and the whole beauty and grandeur of the art consists in being able to get above all singular forms, local customs, particularities, and details of every kind."

After these opinions, however, derived from the practice of the art, and this high authority, it may not be improper to hazard a few observations. Although illusion can be distinguished from many of the most excellent parts of the art taken separately, yet it does not follow that it shall not add in every picture to the beauty of the whole. It is impossible to state it in opposition to design, to composition, to colouring, or to the peculiar manner of a great artist; because all these may exist where there also exists the most perfect illusion. This is evident from the works of art; which have real relievo, and which at the same time are capable of perfection in all those branches, and of showing the peculiar manner of the artist. Again, it appears evident, that *illusion*, properly so called, should be a proper object of attention in painting. We may rate the ideal beauty very high, and with great justice; but it still consists in overcoming the defects in individual objects in nature, and not in departing from the truth of representation. And perhaps it may be alleged, that the impossibility of giving perfect illusion on a plain surface has pushed the greatest masters too far, and made them crowd artificial beauties into their pictures to conceal their want of power to give real ones. It is not improbable that on this very account the art is less perfect than otherwise it might have been. Even in all subjects thought to be impossible, there is not only great room for exertion, but every artist carries the art to greater perfection as he comes nearer to show that it may not be impossible. And if the works of Raphael, in point of illusion, are not superior to an ordinary artist, we may be permitted to say that there is great room for improvement in this branch.

### Sect. XII. *Of the Costume.*

The costume in painting corresponds with the unities of time, place, and action, in tragedy and in epic poetry. It is chiefly confined to history painting; and regards the customs of different periods, the manners, the dress, and the colour, of different nations. Great accuracy in the costume is scarcely practicable; but too great a departure from it denotes unpardonable negligence. It frequently happens that a piece composed of picturesque figures derives considerable advantage from certain liberties which are calculated to please both the artist and the spectator; for the judges of painting are not habitually occupied with the details of ancient and modern history, or profoundly versed in all the circumstances which make a departure from the costume conspicuous. On the other hand, if they were so ignorant as not to understand, or so indifferent as not to regard these circumstances, this branch of the art would be altogether arbitrary. The road of the painter is between these two extremes, not to despise beauty on the one hand, nor probability on the other. But in pursuing this part of the art, it is in vain to seek for perfect models in ancient or modern painting.

"When Raphael in his cartoons introduces monks and Swiss guards; when he puts into a boat more figures, &c.

Manchester Transactions, vol. iii. p. 564.

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gures than it is evident the boat could actually contain; when in the chastisement of Heliodorus, who attempted to despoil the temple of Jerusalem, Pope Julius II. is depicted as being present; when, in the donation of Constantine in the Vatican, a naked boy is placed conspicuous in the fore ground, astride upon a dog in the immediate presence of the pope and the emperor; when Venetian senators are introduced while Pope Alexander excommunicates Barbarossa; when Aristotle, Plato, Dante, and Petrarch, are brought together in the school of Athens, to omit the lesser improprieties of shoeless apostles, &c.—every person must acknowledge that such offences as these against truths so obvious, if they do not arise from a defect of understanding, are instances of inexcusable carelessness.

"In like manner, when the same great master paints the dreams of Joseph and his fellow-prisoner in circles over their heads; when similar contrivances to express future events are used by Albani, Pameggiano, and Fuseli—is it not evident that no possibility can make the fiction true; and that real and feigned existences are unnaturally introduced in one narration?

"When Polydore chooses to represent the death of Cato, and exposes to the spectator the hero of the piece with his bowels gushing out; when Paul Veronese, at a banquet painted with his usual magnificence, places before us a dog gnawing a bone, and a boy making water: however such disgusting circumstances may be forgiven in the *chef d'œuvre* of a Michael Angelo, had he represented these instead of the horrible figures of his day of Judgment, the performance of an inferior artist cannot atone for them.

"So also, when one of the first rate among the modern painters, we mean Paul Veronese, introduces Benedictine monks at the marriage of Cana; when, in a picture of the crucifixion, he puts the Roman soldiers in the jerkins of the 16th century, and adorns their heads with turbans; when Guido, in a painting of Jesus appearing to his mother after his resurrection, places St Charles Borromèe in a kind of desk in the back-ground as witness to the interview; when Tintoret, at the miraculous fall of manna, arms the Israelites with fusils; and Corregio appoints St Jerome as the instructor of the child Jesus—common sense revolts at the impropriety; and we are compelled to exclaim, *Quicquid ostendis mihi sic, incredulus odi!*

"The mythological taste of the learned Poussin is well known; but Rubens seems to claim the merit of having presented to the world a still greater number of supreme absurdities in this learned style: nor is it easy to conceive a more heterogeneous mixture of circumstances, real and imaginary, sacred and profane, than the Luxembourg gallery, and the other works of that great master, perpetually exhibit.

"When so great an authority as Sir Joshua Reynolds* contends for the rejection of common sense in favour of somewhat he terms a *higher sense*; when he laments, indirectly, that art is not in such high estimation with us, as to induce the generals, lawgivers, and kings of modern times, to suffer themselves to be represented naked, as in the days of ancient Greece; when he defends even the ridiculous aberrations from possibility, which the extravagant pencil of Rubens has so plentifully produced—it is not surprising that the artists of the present day should be led to reject the company of common sense; or that Sir Joshua's performances should furnish examples of his own precepts.

* *Discourses*, 8vo, p. 286.

"Mrs Siddons is represented by Sir Joshua in the character (as it is said) of the tragic muse: She is placed in an old-fashioned arm chair; this arm chair is supported by clouds, suspended in the air; on each side of her head is a figure not unapt to suggest the idea of the attendant imps of an enchantress: of these figures, one is supposed to represent Comedy, and the other Tragedy; Mrs Siddons herself is decently attired in the fashionable habilements of 20 or 30 years ago.

"If this be a picture of the tragic muse, she ought not to appear in a modern dress, nor ought she to be seated in an old arm chair. If this be a portraiture of Mrs Siddons, she has no business in the clouds, nor has she any thing to do with aerial attendants. If this be Mrs Siddons in the character of the tragic muse, the first set of objections apply; for she is placed in a situation where Mrs Siddons could never be.

"In the death of Dido, Sir Joshua Reynolds introduces her sister, lamenting over the corpse of the unfortunate queen. This is possible; but he has also introduced Atropos cutting Dido's hair with a pair of scissars, a being equally real and apparent in the painting with Dido or her sister. This (continues our author) appears to me a gross offence against mythological probability; nor is it the only offence against the costume with which that picture is chargeable.

"There is one other breach of the costume, however common among painters, more gross and offensive than any of the instances hitherto alleged; we mean the perpetual and unnecessary display of the naked figure. We shall not stay to enquire whether more skill can be shown in painting the human body clothed or unclothed. If the personages introduced in any picture are more naked in the representation than can be justified by the probability of the times, persons, places, or circumstances, it is a breach of the costume proportionate to the deviation. *This* fault, however, is so common as hardly to be noticed; so slight indeed, when compared with that general taste for voluptuous imagery and obscene representation, which has so long disgraced the art of painting in every stage of its progress, that science and morality are callous to the *slight* offence.

"This depravity of imagination, this prostitution of the pencil to the base purposes of lascivious inclination, was a subject of much complaint among the ancients. Nor is there less reason to complain in modern times, that this delightful art, which might be employed in exciting the noblest sentiments, and become subservient to the best interests of society, should so often be exercised upon subjects solely calculated to please the eye of the voluptuary and debauchee. It is hardly possible to pass through any admired collection without meeting with some of these; of which, however excellent the performance may be, the common feelings of decency and morality (if we are neither professed artists nor connoisseurs) prevent us from viewing them without a mixture of disgust."

*Et pudor aversos texit velamine vultus* *.

* *Ab. é de Marsy.*

Costume

It is impossible to express how much a picture suffers by such looseness of fancy, and sinks as a bastard of the art in the esteem of good judges. Some people, indeed, are of opinion, that so scrupulous an observance of the costume is apt to hurt pictures, by depriving them of a certain air of truth arising, they think, from those features and habits to which we are accustomed; and which are therefore apt to make a greater impression, than can be expected from things drawn from the remote sources of antiquity; adding withal, that a certain degree of licence has ever been allowed those artists who in their works must make fancy their chief guide See, say they, the Greeks; that is, the masters of Raphael and Poussin themselves. Do they ever trouble their heads about such niceties? The Rhodian statuaries, for example, have not scrupled to represent Laocoon naked; that is, the priest of Apollo naked in the very act of sacrificing to the gods, and that too in presence of a whole people, of the virgins and matrons of Ilium. Now, continue they, if it was allowable in the ancient statuaries to neglect probability and decency to such a degree, to have a better opportunity of displaying their skill in the anatomy of the human body; why may it not be allowable in modern painters, the better to attain the end of their art, which is deception, to depart now and then a little from the ancient manners and the too rigorous laws of the costume? But these reasons, we beg leave to observe, are more absurd than they are ingenious. What! are we to draw conclusions from an example, which, far from deciding the dispute, gives occasion to another? The learned are of opinion, that those Rhodian masters would have done much better had they looked out for a subject in which, without offending so much against truth, and even probability, they might have had an equal opportunity of displaying their knowledge of the naked. And certainly no authority or example whatever should tempt us to do any thing contrary to what both decency and the reason of things require, unless we intend, like Carpioni, to represent

*Sogni d'infermi, e fole di romanzi.*

The dreams of sick men, and the tales of fools.

No: a painter, the better to attain the end of his art, which is deception, ought carefully to avoid mixing the antique with the modern, the domestic with the foreign; things, in short, repugnant to each other, and therefore incapable of gaining credit. A spectator will never be brought to consider himself as actually present at the scene, the representation of which he has before him, unless the circumstances which enter it perfectly agree among themselves, and the field of action, if we may use the expression, in no shape belies the action itself. For instance, the circumstances, or, if you please, the accessories, in a *Finding of Moses*, are not, surely, to represent the borders of a canal planted with rows of poppies, and covered with country-houses in the European taste; but the banks of a great river shaded with clusters of palm-trees, with a Sphinx or an Anubis in the adjacent fields, and here and there in the back-ground a towering pyramid. And indeed the painter, before he takes either canvas or paper in hand, should on the wings of fancy transport himself to Egypt, to Thebes, or to Rome; and summoning to his imagination the physiognomy, the dress, the plants, the buildings, suitable to his subject, with the particular spot where he has chosen to lay his scene, so manage his pencil, as, by the magic of it, to make the enraptured spectators fancy themselves there along with him.

Proper Books for a Painter.

## Sect. XIII. *Of proper Books for a Painter.*

From what has been already said, it may be easily gathered, that a painter should be neither illiterate nor unprovided with books. Many are apt to imagine, that the Iconologia of Ripa, or some such collection, is alone sufficient for this purpose; and that all the apparatus he stands in need of, may be reduced to a few casts of the remains of antiquity, or rather to what Rembrandt used to call his *antiques*, being nothing more than coats of mail, turbans, shreds of stuff, and all manner of old household trumpery and wearing apparel. Such things, no doubt, are necessary to a painter, and perhaps enough for one who wants only to paint half-lengths, or is willing to confine himself to a few low subjects. But they are by no means sufficient for him who would soar higher; for a painter who would attempt the Universe, and represent it in all its parts, such as it would appear, had not matter proved refractory to the intentions of the sovereign Artist. Such a painter alone is a true, an universal, a perfect painter.——No mortal, indeed, must ever expect to rise to that sublimity; yet all should aspire to it, on the pain of otherwise ever continuing at a very mortifying distance from it: as the orator, who wishes to make a figure in his profession, should propose to himself no less a pattern than that perfect orator described by Tully; nor the courtier, than that perfect courtier delineated by Castiglione. It cannot, therefore, appear surprising, if we insist on the propriety of reckoning a good collection of books as part of such a painter's implements. The Bible, the Greek and Roman historians, the works of Homer, that prince of poets, and of Virgil, are the most classical. To these let him add the Metamorphoses of Ovid, some of our best poets, the voyage of Pausanias, Vinci, Vasari, and others, upon painting.

*Algaroti on Painting.*

It will also be of considerable advantage to him to have a well chosen collection of drawings by the best masters (D), in order to trace the progress and history of his art, and make himself acquainted with the various styles of painting which have been, and now are, in the greatest vogue. The prince of the Roman school was not ashamed to hang up in his study the drawings of Albert Durer; and spared no pains or expence to acquire

(D) We have formerly (see Anatomy, p. 672. column 2.) mentioned a great anatomical work carrying on by Andrew Bell, Esq; in Edinburgh, of the figures of which, as they are engraved under the inspection of so able an anatomist as Mr Fyse, and with the approbation of Dr Monro, we may at least form a favourable opinion; and if well executed, of which there can be but little doubt, they will unquestionably be of essential service to the painter.

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acquire all the drawings he could meet with that were taken from basso relievos; things which the art of engraving has since rendered so common as to be in every one's hands. This art of multiplying drawings by means of the graver, is of the same date, and boasts the same advantages, with the art of printing, by means of which the works of the mind are multiplied, as it were, at one stroke, and dispersed over the whole world.'

The sight of fine subjects treated by able masters, and the different forms which the same subjects assume in different hands, cannot fail both of enlightening and enflaming the mind of the young painter. The same may be said of the perusal of good poets and historians, with the particulars and proofs of what they advance; not to mention those ideas and flights of invention, with which the former are wont to clothe, beautify, and exalt every thing they take in hand. Bouchardon, after reading Homer, conceived, to use his own words, that men were three times taller than before, and that the world was enlarged in every respect. It is very probable, that the beautiful thought of covering Agamemnon's face with the skirt of his mantle at the sacrifice of Iphigenia, was suggested to Timantes by the tragedy of Euripides. And the sublime conceit of Raphael, who, in a *Creation* of his, represents God in the immense space, with one hand reaching to the sun and the other to the moon, may be considered as the child of the following words of the Psalmist: *The heavens declare the glory of God, and the firmament sheweth his handy-work.*

This thought of Raphael has been, indeed, censured by Mr Webb. "A God (says this gentleman), extending one hand to the sun, and another to the moon, destroys that idea of immensity which should accompany the work of creation, by reducing it to a world of a few inches." But the opinion of Count Algarotti is very different. "For my part, (says that elegant critic), I cannot discover in this painting a world of a few inches, but a world on a much greater scale; a world of millions and millions of miles: and yet this so immense a world, by means of that act of the Godhead, in which with one hand he reaches to the sun, and with the other to the moon, shrinks, in my imagination, to a mere nothing, in respect to the immensity of God himself; which is all that the powers of painting can pretend to. This invention is, though in a contrary sense, of the same kind with that of Timantes, who, to express the enormous size of a sleeping Polyphemus, placed round him some satires measuring the monster's thumb with a thyrsus. Hence Pliny, who relates the fact, takes occasion to tell us, that his works always imply more than they express; and that how great so ever he may be in execution, he is still greater in invention: *Atque in omnibus ejus operibus intelligitur plus semper quam pingitur; et cum ars summa sit, ingenium tamen ultra artem est.*" Nat. Hist. lib. xxxv. c. 10.

The perusal of good authors cannot but be very serviceable to a painter in another respect; as, among the great number of subjects afforded by history and poetry, he may expect to meet with many on which his talents may display themselves to the greatest advantage. A painter can never be too nice in the choice of his arguments; for on the beauty of them, that of his piece will greatly depend. How much to be pitied, therefore, were our first masters, in being so often obliged to receive their subjects from the hands of simple and illiterate persons! and what is worse, to spend all the riches of their art upon barren or unworthy subjects! Such are the representations of those saints, who, though they never had the least intercourse with each other, and perhaps even lived in different ages, are, notwithstanding, to be introduced, *tete à tete*, as it were, in the same picture. The mechanic of the art may, indeed, display itself on these occasions; but by no means the ideal. The disposition may be good and praise-worthy, as in the works of Cortoni and Lanfranc; but we are not to expect in them either invention or expression, which require for their basis the representation of some fact capable of producing such effects. Who does not, on the bare mention of this abuse, immediately recollect many sad instances of it? such as the famous St Cecilia of Raphael, surrounded by St Paul, St Mary Magdalen, St John, and St Augustin; and the picture of Paolo Veronese, in the vestry of the Nuns of St Zachary at Venice, in which St Francis of Assisium, St Catharine, and St Jerome richly habited in his cardinal's robes, form a ring round the Virgin seated on a throne with the child Jesus in her arms; perhaps the most beautiful and picturesque of all the insipid and insignificant pieces with which Italy abounds. It is very shocking to think, that young painters should be obliged to study their art from such wretched compositions.

The subjects in which the pencil triumphs most, and with which a judicious painter may stock himself by the perusal of good books, are, no doubt, those which are most unversally known, which afford the largest field for a display of the passions, and contain the greatest variety of incidents, all concurring, in the same point of time, to form one principal action. Of this the story of Coriolanus besieging Rome, as related by Livy, is a shining example. Nothing can be imagined more beautiful than the scene of action itself, which ought to take in the prætorium in the camp of the Volscians, the Tiber behind it, and the seven hills, among which the towering Capitol is, as it were, to lord it over the rest. It is impossible to conceive a greater variety, than what must appear in that crowd of soldiers, women, and children, all which are to enter the composition; unless, perhaps, it be that of the different passions with which they are severally agitated; some wishing that Coriolanus may raise the siege, others fearing it, others again suspecting it. But the principal groupe forms the picturesque part of the piece. Coriolanus, hastily descending from his tribunal, and hurried on by filial affection, to embrace his mother, stops short through shame, on her crying out to him, Hold! let me first know, if it is a son, or an enemy, I am going to embrace? Thus a painter may impart novelty to the most hacknyed subject, by taking for his guides those authors who possess the happy talent of adding grace and dignity, by their beautiful and sublime descriptions, even to the most common and trifling transactions. Livy, Dec. II. lib. 2.

Sect.

Painter's Balance.

## Sect. XIV. *Of the Painter's Balance.*

The celebrated De Piles, who by his writings has thrown so much light upon painting, in order to assist young painters in forming a right judgment of those masters who hold the first rank in the profession, and to reduce such judgment to the greater precision, bethought himself of a pictorical balance, by means of which a painter's merit may be weighed with the greatest exactness. This merit he divides into Composition, Design, Colouring, and Expression; and in each of these branches he has assigned to every painter that share to which he thought him intitled, according as he approached more or less the highest degree of excellence and summit of perfection; so that, by summing up the numbers which, standing against each master's name, express his share of merit in each of these branches, we have his total merit or value in the art, and may hence gather what rank one painter holds in regard to another. Several objections, it is true, have been started to this method of calculation, by a famous mathematician of our days, who, among other things, insists, that it is the product of the above numbers multiplied by each other, and not the sum of them, that gives the merit of the artist. But this is not a place to enter into such niceties, nor indeed would the doing of it be of any service to the art. The only thing worth our notice is, whether the original numbers, standing for the painter's merit in the several branches of his art, are such as he is really intitled to, without suffering ourselves to be biassed by any partiality, as De Piles has been, in favour of the prince of the Flemish school; the consequence of which, strange as it may appear, is, that in his balance Raphael and Rubens exactly turn out of the same weight.

See Mairan's remarks, in *Mem. de l'Acad. des Sciences.* 1753.

The idea of the painter's balance is doubtless curious, and therefore deserved to be mentioned; but as the merits of the most eminent painters have been already appretiated under the second section of the historical part of our article, to which we refer, it is needless to be more particular here, or to repeat what has been already treated of at sufficient length.

## Sect. XV. *Practical Observations.*

Having thus laid down the principles of the art, and ventured to give the student some directions with regard to his studies, we shall conclude this part of the subject with a few observations relative wholly to practice.

And, 1. The young painter must be careful not to be led astray by the ambition of composing easily, or attaining what is called a *masterly handling* of the chalk or the pencil; a pernicious attempt, by which students are excluded from all power of advancing in real excellence. To this attempt, however, young men have not only the frivolous ambition of being thought masterly, inciting them on the one hand, but also their natural sloth tempting them on the other. They are terrified at the prospect before them, and of the toil required to obtain exactness; whilst the lives of the most eminent painters furnish us with examples of the most unceasing industry. When they conceived a subject, they first made a variety of sketches; then a finished drawing of the whole; after that a more correct drawing of every separate part, heads, hands, feet, and pieces of drapery; they then painted the picture, and after all retouched it from the life. The pictures thus wrought with such care, now appear like the effects of enchantment, and as if some mighty genius had struck them off at a blow.

Practical Observations.

But a student is not always advancing because he is employed; he must apply his strength to that part of the art where the real difficulties lie; to that part which distinguishes it as a liberal art, and not by mistaken industry lose his time in that which is merely ornamental. The students, instead of vying with each other who shall have the readiest hand, should be taught to labour who shall have the purest and most correct outline; instead of striving who shall produce the brightest tint, or endeavouring to give the gloss of stuffs so as to make them appear real, let their ambition be directed to contend, who shall dispose his drapery in the most graceful folds, and give the greatest dignity to the human form.

He who endeavours to copy accurately the figure before him, not only acquires a habit of exactness and precision, but is continually advancing in his knowledge of the human figure; and though he seems to superficial observers to make a slower progress, he will be found at last capable of adding (without running into capricious wildness) that grace and beauty which is necessary to be given to his more finished works, and which cannot be got by the moderns, as it was not acquired by the ancients, but by an attentive and well-directed study of the human form.

2. It is, in the next place, a matter of great importance, that the drawings on which the young artist first exercises his talents be of the most excellent kind. Let the profiles, the hands, and the feet given him to copy, be of the best masters, so as to bring his eye and his hand early acquainted with the most elegant forms and the most beautiful proportions. A painter who has early acquired a fine taste, finds it an easy matter to give dignity to the meanest features, while even the works of a Praxiteles or a Glycon are seen to suffer in the hands of another. A vessel will ever retain the scent which it has first contracted.

3. It would be proper also to make the pupil copy some fine heads from the Greek and Roman medals; not so much for the reason just laid down, as to make him acquainted, if we may use the expression, with those personages which in time he may have occasion to introduce into his pieces, and, above all, to improve him early in the art of copying from relief. Hence he will learn the rationale of light and shade, and the nature of that chiaro-scuro by which it is, properly speaking, that the various forms of things are distinguished.

There is no danger of studying too much the works of the greatest masters, either in painting or sculpture; but how they may be studied to advantage is an inquiry of great importance. "Some (says Sir Joshua Reynolds), who have never raised their minds to the consideration of the real dignity of the art, and who rate the works of an artist in proportion as they excel or are defective in the mechanical parts, look on theory as something that may enable them to talk, but

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but not to paint better; and, confining themselves entirely to mechanical practice, very assiduously toil in the drudgery of copying, and think they make a rapid progress, while they faithfully exhibit the minutest part of a favourite picture. This appears to me a very tedious, and, I think, a very erroneous method of proceeding. Of every large composition, even of those which are most admired, a great part may be truly said to be common place. This, though it takes up much time in copying, conduces little to improvement. I consider general copying as a delusive kind of industry: the student satisfies himself with the appearance of doing something; he falls into the dangerous habit of imitating without selecting, and of labouring without any determinate object: as it requires no effort of the mind, he sleeps over his work; and those powers of invention and composition which ought particularly to be called out, and put in action, lie torpid, and lose their energy for want of exercise.

"However, as the practice of copying is not entirely to be excluded, since the mechanical practice of painting is learned in some measure by it, let those choice parts only be selected which have recommended the work to notice. If its excellence consists in its general effect, it will be proper to make slight sketches of the machinery and general management of the picture. Those sketches should be kept always by you, for the regulation of your style. Instead of copying the touches of those great masters, copy only their conceptions. Instead of treading in their footsteps, endeavour only to keep the same road. Labour to invent on their general principles and way of thinking. Possess yourself with their spirit. Consider with yourself how a Michael Angelo or a Raphael would have treated this subject, and work yourself into a belief that your picture is to be seen and criticised by them when completed. Even an attempt of this kind will rouse your powers."

The same great master recommends to students to keep their minds fixed on the highest excellencies.— "If you compass them, and compass nothing more, you are still in the first class. We may regret the innumerable beauties which you may want: you may be very imperfect; but still you are an imperfect person of the highest order.

"I inculcate as frequently as I can your forming yourselves upon great principles and great models.— Your time will be much mispent in every other pursuit. Small excellencies should be viewed, not studied; they ought to be viewed, because nothing ought to escape a painter's observation, but for no other reason.

"There is another caution which I wish to give you. Be as select in those whom you endeavour to please, as in those whom you endeavour to imitate. Without the love of fame you can never do any thing excellent; but by an excessive and undistinguishing thirst after it, you will come to have vulgar views; you you will degrade your style; and your taste will be entirely corrupted. It is certain that the lowest style will be the most popular, as it falls within the compass of ignorance itself, and the vulgar will always be pleased with what is natural in the confined and misunderstood sense of the word."

Genius he considers as an improveable talent, never to be destroyed by the most excessive, if well directed, application, and displaying the elegancies of the art in proportion to the number of ideas which have been carefully collected and digested in the mind.

He cautions painters, therefore, in every stage of their progress, to beware of that false opinion, but too prevalent among artists, of the imaginary power of native genius, and its sufficiency in great works. This opinion, according to the temper of mind it meets with, almost always produces, either a vain confidence or a sluggish despair, both equally fatal to all proficiency. "Study, therefore, the great works of the great masters for ever. Study, as nearly as you can, in the order, in the manner, on the principles on which they studied. Study nature attentively, but always with those masters in your company: consider them as models which you are to imitate, and at the same time as rivals whom you are to combat.

## PART II. Of the Different Classes of Painting.

### Sect. I. *General Enumeration.*

As all the objects in nature are susceptible of imitation by the pencil, the masters of this art have applied themselves to different subjects, each one as his talents, his taste, or inclination may have led him.— From whence have arisen the following classes.

I. *History-painting:* which represents the principal events in history sacred and profane, real or fabulous; and to this class belongs *allegorical expression.* These are the most sublime productions of the art; and in which Raphael, Guido, Rubins, Le Brun, &c. have excelled.

II. *Rural-history;* or the representation of a country life, of villages and hamlets, and their inhabitants. This is an inferior class; and in which Teniers, Breughel, Watteau, &c. have great reputation, by rendering it at once pleasing and graceful.

III. *Portrait-painting;* which is an admirable branch of this art, and has engaged the attention of the greatest masters in all ages, as Appelles, Guido, Vandyke, Rembrandt, Regauds, Pesne, Kneller, La Tour, &c.

IV. *Grotesque histories;* as the nocturnal meetings of witches, sorceries and incantations; the operations of mountebanks, &c. a sort of painting in which the younger Breughill, Teniers, and others, have exercised their talents with success.

V. *Battle-pieces;* by which Huchtemberg, Wouwerman, &c. have rendered themselves famous.

VI. *Landscapes;* a charming species of painting, that has been treated by masters of the greatest genius in every nation.

VII. *Landscapes diversified with waters,* as rivers, lakes, cataracts, &c.; which require a peculiar talent, to express the water sometimes smooth and transparent,

General parent, and at others foaming and rushing furiously along.

VIII. *Sea-pieces*; in which are represented the ocean, harbours, and great rivers; and the vessels, boats, barges, &c. with which they are covered; sometimes in a calm, sometimes with a fresh breeze, and at others in a storm. In this class Backhuysen, Vandervelde, Blome, and many others, have acquired great reputation.

IX. *Night-pieces*; which represent all sorts of objects, either as illuminated by torches, by the flames of a conflagration, or by the light of the moon. Schalk, Vanderneer, Vanderpool, &c. have here excelled.

X. *Living Animals*: A more difficult branch of painting than is commonly imagined; and in which Rosa, Carré, Vandervelde, and many others, have succeeded marvellously well.

XI. *Birds of all kinds*; a very laborious species, and which requires extreme patience minutely to express the infinite variety and delicacy of their plumage.

XII. *Culinary-pieces*; which represent all sorts of provisions, and animals without life, &c. A species much inferior to the rest, in which nature never appears to advantage, and which requires only a servile imitation of objects that are but little pleasing. The painting of fishes is naturally referred to this class.

XIII. *Fruit-pieces*, of every kind, imitated from nature.

XIV. *Flower-pieces*; a charming class of painting, where Art in the hands of Huyzom, P. Segerts, Merian, &c. becomes the rival of Nature. *Plants* and *insects* are usually referred to the painters of flowers, who with them ornament their works.

XV. *Pieces of architecture*; a kind of painting in which the Italians excel all others. Under this class may be comprehended the representations of ruins, sea-ports, streets, and public places; such as are seen in the works of Canaletti, and other able masters.

XVI. *Instruments of music, pieces of furniture*, and other inanimate objects; a trifling species, and in which able painters only accidentally employ their talents.

XVII. *Imitations of bas reliefs*; a very pleasing kind of painting, and which may be carried by an able hand to a high degree of excellence.

XVIII. *Hunting-pieces*: these also require a peculiar talent, as they unite the painting of men, horses, dogs, and game, to that of landscapes.

It will not be expected that we should here give the rules that the painter is to observe in handling each particular subject. What has been said on historical painting (Part I.*) may throw some light on the rest, and the particular rules must be learned from the study of the art itself. Good masters, academies of reputation, and a rational practice, are the sources from whence the young painter must derive the detail of his art. We shall however insert some rules and observations relative to *Landscape* and *Portrait*; these, with *History painting* (already pretty fully treated), forming the principal branches of the art.

* In the sections of *Invention* and *Disposition*.

## Sect II. *Of Landscapes.*

Landscape-painting includes every object that the country presents: and it is distinguished into the *heroic*, and the *pastoral* or *rural*; of which indeed all other styles are but mixtures.

The *heroic style* is a composition of objects, which in their kinds draw both from art and nature every thing that is great and extraordinary in either. The situations are perfectly agreeable and surprising. The only buildings are temples, pyramids, ancient places of burial, altars consecrated to the divinities, pleasure-houses of regular architecture; and if nature appear not there as we every day casually see her, she is at least represented as we think she ought to be. This style is an agreeable illusion, and a sort of enchantment, when handled by a man of fine genius and a good understanding, as Poussin was, who has so happily expressed it. But if, in the course of this style, the painter has not talent enough to maintain the sublime, he is often in danger of falling into the childish manner.

De Piles on Painting.

The *rural style* is a representation of countries, rather abandoned to the caprice of nature, than cultivated: we there see nature simple, without ornament, and without artifice; but with all those graces wherewith she adorns herself much more when left to herself than when constrained by art.

In this style, situations bear all sorts of varieties: sometimes they are very extensive and open, to contain the flocks of the shepherds; at others very wild, for the retreat of solitary persons, and a cover for wild beasts.

It rarely happens that a painter has a genius extensive enough to embrace all the parts of painting: there is commonly some one part that pre-engages our choice, and so fills our mind, that we forget the pains that are due to the other parts; and we seldom fail to see, that those whose inclination leads them to the heroic style, think they have done all, when they have introduced into their compositions such noble objects as will raise the imagination, without ever giving themselves the trouble to study the effects of good colouring. Those, on the other hand, who practise the pastoral, apply closely to colouring, in order to represent truth more lively. Both these styles have their sectaries and partisans. Those who follow the heroic, supply by their imagination what it wants of truth, and they look no farther.

As a counterbalance to heroic landscape, it would be proper to put into the pastoral, besides a great character of truth, some affecting, extraordinary, but probable effect of nature, as was Titian's custom.

There is an infinity of pieces wherein both these styles happily meet; and which of the two has the ascendant, will appear from what we have been just observing of their respective properties. The chief parts of landscapes are, their openings or situations, accidents, skies and clouds, offskips and mountains, verdure or turfing, rocks, grounds, or lands, terraces, fabrics, waters, fore-grounds, plants, figures, and trees; of all which in their places

*Of Openings or Situations.* The word *site*, or situation, signifies the "view, prospect, or opening of a country." It is derived from the Italian word *sito*; and our painters have brought it into use, either because they were used to it in Italy, or because, as we think, they found it to be very expressive.

Situations ought to be well put together; and so dis-

Land-scapes.

engaged in their make, that the conjunction of grounds may not seem to be obstructed, though we should see but a part of them.

Situations are various, and represented according to the country the painter is thinking of: as either open or close, mountainous or watery, tilled and inhabited, or wild and lonely; or, in fine, variegated by a prudent mixture of some of these. But if the painter be obliged to imitate nature in a flat and regular country, he must make it agreeable by a good disposition of the *claro-obscuro*, and such pleasing colouring as may make one soi unite with another.

It is certain, that extraordinary situations are very pleasing, and cheer the imagination by the novelty and beauty of their makes, even when the local colouring is but moderately performed: because, at worst, such pictures are only looked on as unfinished, and wanting to be completed by some skilful hand in colouring; whereas common situations and objects require good colouring and absolute finishing, in order to please. It was only by these properties that Claude Lorrain has made amends for his insipid choice in most of his situations. But in whatever manner that part be executed, one of the best ways to make it valuable, and even to multiply and vary it without altering its form, is properly to imagine some ingenious accident in it.

*Of Accidents*. An accident in painting is an obstruction of the sun's light by the interposition of clouds, in such manner, that some parts of the earth shall be in light and others in shade, which, according to the motion of the clouds, succeed each other, and produce such wonderful effects and changes of the *claro-obscuro*, as seem to create so many new situations. This is daily observed in nature. And as this newness of situations is grounded only on the shapes of the clouds, and their motions, which are very inconstant and unequal, it follows, that these accidents are arbitrary; and a painter of genius may dispose them to his own advantage when he thinks fit to use them: For he is not absolutely obliged to do it; and there have been some able landscape-painters who have never practised it, either through fear or custom, as Claude Lorrain and some others.

*Of the Sky and Clouds*. The sky, in painters terms, is the ethereal part over our heads; but more particularly the air in which we breathe, and that where clouds and storms are engendered. Its colour is blue, growing clearer as it approaches the earth, because of the interposition of vapours arising between the eye and the horizon; which, being penetrated by the light, communicates it to objects in a greater or lesser degree, as they are more or less remote.

But we must observe, that this light being either yellow or reddish in the evening, at sunset, these same objects partake not only of the light, but of the colour: thus the yellow light mixing with the blue, which is the natural colour of the sky, alters it, and gives it a tint more or less greenish, as the yellowness of the light is more or less deep.

This observation is general and infallible: but there is an infinity of particular ones, which the painter must make upon the natural, with his pencil in his hand, when occasion offers; for there are very fine and singular effects appearing in the sky, which it is difficult to make one conceive by physical reasons. Who can tell, for example, why we see, in the bright part of some clouds, a fine red, when the source of the light which plays upon them is a most lively and distinguishing yellow? Who can account for the different reds seen in different clouds, at the very moment that these reds receive the light but in one place? for these colours and surprising appearances seem to have no relation to the rainbow, a phenomenon for which the philosopher pretends to give solid reasons.

These effects are all seen in the evening when the weather is inclining to change, either before a storm, or after it, when it is not quite gone, but has left some remains of it to draw our attention.

The property of clouds is to be thin and airy, both in shape and colour: their shapes, though infinite, must be studied and chosen after nature, at such times as they appear fine. To make them look thin, we ought to make their grounds unite thinly with them, especially near their extremities, as if they were transparent: And if we would have them thick, their reflections must be so managed, as, without destroying their thinness, they may seem to wind and unite, if necessary, with the clouds that are next to them. Little clouds often discover a little manner, and seldom have a good effect, unless when, being near each other, they seem altogether to make but one object.

In short, the character of the sky is to be luminous; and, as it is even the source of light, every thing that is upon the earth must yield to it in brightness: If, however, there is any thing that comes near it in light, it must be waters, and polished bodies which are susceptible of luminous reflections.

But whilst the painter makes the sky luminous, he must not represent it always shining throughout.

On the contrary, he must contrive his light so, that the greatest part of it may fall only upon one place: and, to make it more apparent, he must take as much care as possible to put it in opposition to some terrestrial object, that may render it more lively by its dark colour; as a tree, tower, or some other building that is a little high.

This principal light might also be heightened, by a certain disposition of clouds having a supposed light, or a light ingeniously inclosed between clouds, whose sweet obscurity spreads itself by little and little on all hands. We have a great many examples of this in the Flemish school, which best understood landscape; as Paul Bril, Brugel, Saveri: And the Sadelers and Merian's prints give a clear idea of it, and wonderfully awaken the genius of those who have the principles of the *claro-scuro*.

*Of Offskips and Mountains*. Offskips have a near affinity with the sky; it is the sky which determines either the force of faintness of them. They are darkest when the sky is most loaded, and brightest when it is most clear. They sometimes intermix their shapes and lights; and there are times, and countries, where the clouds pass between the mountains, whose tops rise and appear above them. Mountains that are high, and covered with snow, are very proper to produce extraordinary effects in the offskip, which are advantageous to the painter, and pleasing to the spectator.

The disposition of offskips is arbitrary; let them only

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only agree with the whole together of the picture, and the nature of the country we would represent. They are usually blue, because of the interposition of air between them and the eye: but they lose this colour by degrees, as they come nearer the eye, and so take that which is natural to the objects.

In distancing mountains, we must observe to join them insensibly by the roundings off, which the reflections make probable; and must, among other things, avoid a certain edginess in their extremities, which makes them appear in slices, as if cut with scissars, and stuck upon the cloth.

We must further observe, that the air, at the feet of mountains, being charged with vapours, is more susceptible of light than at their tops. In this case, we suppose the main light to be set reasonably high, and to enlighten the mountains equally, or that the clouds deprive them of the light of the sun. But if we suppose the main light to be very low, and to strike the mountains, then their tops will be strongly enlightened, as well as every thing else in the same degree of light.

Though the forms of things diminish in bigness, and colours lose their strength, in proportion as they recede from the first plan of the picture, to the most remote offskip, as we observe in nature and common practice; yet this does not exclude the use of the accidents. These contribute greatly to the wonderful in landscape, when they are properly introduced, and when the artist has a just idea of their good effects.

*Of Verdure, or Turfing.* By turfing is meant the greenness with which the herbs colour the ground: This is done several ways; and the diversity proceeds not only from the nature of plants, which, for the most part, have their particular verdures, but also from the change of seasons, and the colour of the earth, when the herbs are but thin sown. By this variety, a painter may choose or unite, in the same tract of land, several sorts of greens, intermixed and blended together, which are often of great service to those who know how to use them; because this diversity of greens, as it is often found in nature, gives a character of truth to those parts, where it is properly used. There is a wonderful example of this part of landscape, in the view of Mechlin, by Rubens.

*Of Rocks.* Though rocks have all sorts of shapes, and participate of all colours, yet there are in their diversity, certain characters which cannot be well expressed without having recourse to nature. Some are in banks, and set off with beds of shrubs; others in huge blocks, either projecting or falling back; others consist of large broken parts, contiguous to each other; and others, in short, of an enormous size, all in one stone, either naturally, as free-stone, or else through the injuries of time, which in the course of many ages has worn away their marks of separation. But, whatever their form be, they are usually set out with clefts, breaks, hollows, bushes, moss, and the stains of time; and these particulars, well managed, create a certain idea of truth.

Rocks are of themselves gloomy, and only proper for solitudes: but where accompanied with bushes, they inspire a fresh air; and when they have waters, either proceeding from, or washing them, they give an infinite pleasure, and seem to have a soul which animates them, and makes them sociable.

*Of Grounds or Lands.* A ground or land, in painters terms, is a certain distinct piece of land, which is neither too woody nor hilly. Grounds contribute, more than any thing, to the gradation and distancing of landscape; because they follow one another, either in shape, or in the *claro-obscuro*, or in their variety of colouring, or by some insensible conjunction of one with another.

Multiplicity of grounds, though it be often contrary to grand manner, does not quite destroy it; for, besides the extent of country which it exhibits, it is susceptible of the accidents we have mentioned, and which, with good management, have a fine effect.

There is one nicety to be observed in grounds, which is, that in order to characterize them well, care must be taken, that the trees in them have a different verdure and different colours from those grounds; though this difference, withal, must not be too apparent.

*Of Terraces.* A terrace in painting, is a piece of ground, either quite naked or having very little herbage, like great roads and places often frequented. They are of use chiefly in the foregrounds of a picture, where they ought to be very spacious and open, and accompanied, if we think fit, with some accidental verdure, and also with some stones, which, if placed with judgment, give a terrace a greater air of probability.

*Of Buildings.* Painters mean by buildings any structures they generally represent, but chiefly such as are of a regular architecture, or at least are most conspicuous. Thus building is not so proper a name for the houses of country-people, or the cottages of shepherds, which are introduced into the *rural* taste, as for regular and showy edifices, which are always brought into the *heroic*.

Buildings in general are a great ornament in landscapes, even when they are Gothic, or appear partly inhabited and partly ruinous: they raise the imagination by the use they are thought to be designed for; as appears from ancient towers, which seem to have been the habitations of fairies, and are now retreats for shepherds and owls.

Poussin has very elegantly handled the Roman manner of architecture in his works, as Bourdon has done the Gothic; which, however Gothic, fails not to give a sublime air to his landscapes. Little Bernard has introduced into his sacred history what may be called a Babylonian manner; which, extraordinary as it is, has its grandeur and magnificence. Nor ought such pieces of architecture to be quite rejected: they raise the imagination; and perhaps would succeed in the heroic style, if they were placed among half-distant objects, and if we knew how to use them properly.

*Of Waters.* Much of the spirit of landscape is owing to the waters which are introduced in it. They appear in divers manners; sometimes impetuous, as when a storm makes them overflow their banks; at other times rebounding, as by the fall of a rock; at other times, through unusual pressure, gushing out and dividing into an infinity of silver streams, whose motion and murmuring agreeably deceive both the eye and

ear;

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ear; at other times calm and purling in a sandy bed; at other times so still and standing, as to become a faithful looking-glass, which doubles all the objects that are opposite to it; and in this state they have more life than in the most violent agitation. Consult Bourdon's works, or at least his prints, on this subject: he is one of those who have treated of waters with the greatest spirit and best genius.

Waters are not proper for every situation: but to express them well, the artist ought to be perfect master of the exactness of watery reflections; because they only make painted water appear as real: for practice alone, without exactness, destroys the effect, and abates the pleasure of the eye. The rule for these reflections is very easy, and therefore the painter is the less pardonable for neglecting it.

But it must be observed, that though water be as a looking glass, yet it does not faithfully represent objects but when it is still; for if it be in any motion, either in a natural course, or by the driving of the wind, its surface becoming uneven, receives on its surges such lights and shades as, mixing with the appearance of the objects, confound both their shapes and colours.

*Of the Foreground of a Picture.* As it is the part of the foreground to usher the eye into the piece, great care must be taken that the eye meet with good reception; sometimes by the opening of a fine terrace, whose design and workmanship may be equally curious; sometimes by a variety of well-distinguished plants, and those sometimes flowered; and at other times, by figures in a lively taste, or other objects, either admirable for their novelty or introduced as by chance.

In a word, the artist cannot too much study his foreground objects, since they attract the eye, impress the first character of truth, and greatly contribute to make the artifice of a picture successful, and to anticipate our esteem for the whole work.

*Of Plants.* Plants are not always necessary in foregrounds, because, as we have observed, there are several ways of making those grounds agreeable. But if we resolve to draw plants there, we ought to paint them exactly after the life; or at least, among such as we paint practically, there ought to be some more finished than the rest, and whose kinds may be distinguished by the difference of design and colouring, to the end that, by a probable supposition, they may give the others a character of truth. What has been said here of plants may be applied to the branches and barks of trees.

*Of Figures.* In composing landscape, the artist may have intended to give it a character agreeable to the subject he has chosen, and which his figures ought to represent. He may also, and it commonly happens, have only thought of his figures, after finishing his landscape. The truth is, the figures in most landscapes are made rather to accompany than to suit them.

It is true, there are landscapes so disposed and situated, as to require only passing figures; which several good masters, each in his style, have introduced, as Poussin in the heroic, and Fouquier in the rural, with all probability and grace. It is true also, that resting figures have been made to appear inwardly active. And these two different ways of treating figures are not to be blamed, because they act equally, though in a different manner. It is rather inaction that ought to be blamed in figures; for in this condition, which robs them of all connection with the landscape, they appear to be pasted on. But without obstructing the painter's liberty in this respect, undoubtedly the best way to make figures valuable is, to make them so to agree with the character of the landscape, that it may seem to have been made purely for the figures. We would not have them either insipid or indifferent, but to represent some little subject to awaken the spectator's attention, or else to give the picture a name of distinction among the curious.

Great care must be taken to proportion the size of the figures to the bigness of the trees, and other objects of the landscape. If they be too large, the picture will discover a little manner; and if too small, they will have the air of pigmies; which will destroy the worth of them, and make the landscape look enormous. There is, however, a greater inconvenience in making figures too large than too small; because the latter at least gives an air of greatness to all the rest. But as landscape figures are generally small, they must be touched with spirit, and such lively figures as will attract, and yet preserve probability and a general union. The artist must, in fine, remember, that as the figures chiefly give life to a landscape, they must be dispersed as conveniently as possible.

*Of Trees.* The beauty of trees is perhaps one of the greatest ornaments of landscape; on account of the variety of their kinds, and their freshness, but chiefly their lightness, which makes them seem, as being exposed to the air, to be always in motion.

Though diversity be pleasing in all the objects of landscape, it is chiefly in trees that it shows its greatest beauty. Landscape considers both their kinds and their forms. Their kinds require the painter's particular study and attention, in order to distinguish them from each other; for we must be able at first sight to discover which are oaks, elms, firs, sycamores, populars, willows, pines, and other such trees, which, by a specific colour, or touching, are distinguishable from all other kinds. This study is too large to be acquired in all its extent; and, indeed, few painters have attained such a competent exactness in it as their art requires. But it is evident, that those who come nearest to perfection in it, will make their works infinitely pleasing, and gain a great name.

Besides the variety which is found in each kind of tree, there is in all trees a general variety. This is observed in the different manners in which their branches are disposed by a sport of nature; which takes delight in making some very vigorous and thick, others more dry and thin; some more green, others more red or yellow. The excellence of practice lies in the mixture of these varieties: but if the artist can distinguish the sorts but indifferently, he ought at least to vary their makes and colours; because repetition in landscape is as tiresome to the eye, as monotony in discourse is to the ear.

The variety of their makes is so great, that the painter would be inexcusable not to put it in practice upon occasion, especially when he finds it necessary to awaken the spectator's attention; for, among trees, we discover the young and the old, the open and close, tapering and squat, bending upwards and downwards, stooping

ſtooping and ſhooting: in ſhort, the variety is rather to be conceived than expreſſed. For inſtance, the character of young trees is, to have long ſlender branches, few in number, but well ſet out; boughs well divided, and the foliage vigorous and well ſhaped: whereas, in old trees, the branches are ſhort, ſtocky, thick, and numerous; the tufts blunt, and the foliage unequal and ill ſhaped: but a little obſervation and genius will make us perfectly ſenſible of theſe particulars.

In the various makes of trees, there muſt alſo be a diſtribution of branches, that has a juſt relation to, and probable connection with, the boughs or tufts, ſo as mutually to aſſiſt each other in giving the tree an appearance of thickneſs and of truth. But, whatever their natures or manners of branching be, let it be remembered, that the handling muſt be lively and thin, in order to preſerve the ſpirit of their characters.

Trees likewiſe vary in their barks, which are commonly grey; but this grey, which in thick air, and low and marſhy places, looks blackiſh, appears lighter in a clear air: and it often happens, in dry places, that the bark gathers a thin moſs, which makes it look quite yellow; ſo that, to make the bark of a tree apparent, the painter may ſuppoſe it to be light upon a dark ground, and dark on a light one.

The obſervation of the different barks merits a particular attention; for it will appear, that, in hard woods, age chaps them, and thereby gives them a ſort of embroidery; and that, in proportion as they grow old, theſe chaps grow more deep. And other accidents in barks may ariſe either from moiſture, or dryneſs, or green moſſes, or white ſtains of ſeveral trees.

The barks of white woods will alſo afford much matter for practice, if their diverſity be duly ſtudied; and this conſideration leads us to ſay ſomething of the ſtudy of landſcape.

*Of the Study of Landſcape.* The ſtudy of landſcape may be conſidered either with reſpect to beginners, or to thoſe who have made ſome advances in it.

Beginners will find, in practice, that the chief trouble of landſcape lies in handling trees; and it is not only in practice, but alſo in ſpeculation, that trees are the moſt difficult part of landſcape, as they are its greateſt ornament. But it is only propoſed here, to give beginners an idea of trees in general, and to ſhow them how to expreſs them well. It would be needleſs to point out to them the common effects of trees and plants, becauſe they are obvious to every one; yet there are ſome things, which, though not unknown, deſerve our reflection. We know, for inſtance, that all trees require air, ſome more, ſome leſs, as the chief cauſe of their vegetation and production; and for this reaſon, all trees (except the cypreſs, and ſome others of the ſame kind) ſeparate in their growth from one another, and from other ſtrange bodies as much as poſſible, and their branches and foliage do the ſame: wherefore, to give them that air and thinneſs, which is their principal character, the branches, boughs, and foliage, muſt appear to fly from each other, to proceed from oppoſite parts, and be well divided And all this without order; as if chance aided nature in the fanciful diverſity. But to ſay particularly how theſe trunks, branches, and foliages, ought to be diſtributed, would be needleſs, and only a deſcription of the works of great maſters: a little reflection on nature will be of more ſervice than all that can be ſaid on this head. By great maſters, we mean ſuch as have publiſhed prints; for thoſe will give better ideas to young copyiſts than even the paintings themſelves.

Among the many great maſters of all ſchools, De Piles prefers Titian's wooden prints, where the trees are well ſhaped; and thoſe which Cornelius Cort and Agoſtino Carracci have engraved. And he aſſerts, that beginners can do no better than contract, above all things, an habit of imitating the touches of theſe great maſters, and of conſidering at the ſame time the perſpective of the branches and foliages, and obſerving how they appear, either when riſing and ſeen from below, or when ſinking and ſeen from above, or when fronting and viewed from a point, or when they appear in profile; and, in a word, when ſet in the various views in which nature preſents them, without altering their characters.

After having ſtudied and copied with the pen or crayon, firſt the prints, and then the deſigns of Titian and Carracci, the ſtudent ſhould imitate with the pencil thoſe touches which they have moſt diſtinctly ſpecified, if their paintings can be procured: but ſince they are ſcarce, others ſhould be got which have a good character for their touching; as thoſe of Foquier, who is a moſt excellent model: Paul Bril, Breugel, and Bourdon, are alſo very good; their touching is neat, lively, and thin.

After having duly weighed the nature of trees, their ſpread and order, and the diſpoſition of their branches, the artiſt muſt get a lively idea of them, in order to keep up the ſpirit of them throughout, either by making them apparent and diſtinct in the foregrounds, or obſcure and confuſed in proportion to their diſtance.

After having thus gained ſome knowledge in good manner, it will next be proper to ſtudy after nature, and to chooſe and rectify it according to the idea which the aforeſaid great maſters had of it. As to perfection, it can only be expected from long practice and perſeverance. On the whole, it is proper for thoſe who have an inclination for landſcape, above all things to take the proper methods for beginning it well.

As for thoſe, who have made ſome advances in this part of painting, it is proper they ſhould collect the neceſſary materials for their further improvement, and ſtudy thoſe objects at leaſt which they ſhall have moſt frequent occaſion to repreſent.

Painters uſually compriſe, under the word *ſtudy*, any thing whatever which they either deſign or paint ſeparately after the life; whether figures, heads, feet, hands, draperies, animals, mountains, trees, plants, flowers, fruits, or whatever may confirm them in the juſt imitation of nature: the drawing of theſe things is what they call *ſtudy*; whether they be for inſtruction in deſign, or only to aſſure them of the truth, and to perfect their work. In fact, this word *ſtudy* is the more properly uſed by painters, as in the diverſity of nature they are daily making new diſcoveries, and confirming themſelves in what they already know.

As the landſcape-painter need only ſtudy ſuch objects as are to be met with in the country, we would recommend

recommend to him some order, that his drawings may be always at hand when he wants them. For instance, he should copy after nature, on separate papers, the different effects of trees in general, and the different effects of each kind in particular, with their trunks, foliage, and colours. He should also take the same method with some sorts of plants, because their variety is a great ornament to terraces on fore-grounds. He ought likewise to study the effects of the sky in the several times of the day and seasons of the year, in the various dispositions of clouds, both in serene, thundering, and stormy weather; and in the offskip, the several sorts of rocks, waters, and other principal objects.

These drawings, which may be made at different times, should be collected together; and all that relate to one matter be put into a book, to which the artist may have recourse at any time for what he wants.

Now, if the fine effects of nature, whether in shape or colour, whether for an entire picture or a part of one, be the artist's study; and if the difficulty lies in choosing those effects well, he must for this purpose be born with good sense, good taste, and a fine genius; and this genius must be cultivated by the observations which ought to be made on the works of the best masters, how they choose nature, and how, while they corrected her, according to their art, they preserved her character. With these advantages, derived from nature and perfected by art, the painter cannot fail to make a good choice; and, by distinguishing between the good and the bad, must needs find great instruction even from the most common things.

To improve themselves in this kind of studies, painters have taken several methods.

There are some artists who have designed after nature, and in the open fields; and have there quite finished those parts which they had chosen, but without adding any colour to them.

Others have drawn, in oil colours, in a middle tint, on strong paper; and found this method convenient, because, the colours sinking, they could put colour on colour, though different from each other. For this purpose they took with them a flat box, which commodiously held their pallet, pencils, oil, and colours. This method, which indeed requires several implements, is doubtless the best for drawing nature more particularly, and with greater exactness, especially if, after the work be dry and varnished, the artist return to the place where he drew, and retouch the principal things after nature.

Others have only drawn the outlines of objects, and slightly washed them in colours near the life, for the ease of their memory. Others have attentively observed such parts they had a mind to retain, and contented themselves with committing them to their memory, which upon occasion gave them a faithful account of them. Others have made drawings in pastil and wash together. Others, with more curiosity and patience, have gone several times to the places which were to their taste: the first time they only made choice of the parts, and drew them correctly; and the other times were spent in observing the variety of colouring, and its alterations through change of light.

Now these several methods are very good, and each may be practised as best suits the student and his temper: but they require the necessaries of painting, as colours, pencils, pastils, and leisure. Nature, however, at certain times, presents extraordinary but transient beauties, and such as can be of no service to the artist who has not as much time as is necessary to imitate what he admires. The best way, perhaps, to make advantage of such momentary occasions, is this:

The painter being provided with a quire of paper, and a black-lead pencil, let him quickly, but slightly, design what he sees extraordinary; and, to remember the colouring, let him mark the principal parts with characters, which he may explain at the bottom of the paper, as far as is necessary for himself to understand them: A cloud, for instance, may be marked A, another cloud B, a light C, a mountain D, a terrace E, and so on. And having repeated these letters at the bottom of the paper, let him write against each that it is of such or such a colour; or for greater brevity, only *blue*, *red*, *violet*, *grey*, &c. or any other shorter abbreviation. After this, he must go to painting as soon as possible; otherwise most of what he has observed will, in a little time, slip out of his memory. This method is the more useful, as it not only prevents our losing an infinity of sudden and transitory beauties, but also helps, by means of the aforesaid marks and characters, to perfect the other methods we have mentioned.

If it be asked, Which is the properest time for these studies? the answer is, That nature should be studied at all times, because she is to be represented at all seasons; but autumn yields the most plentiful harvest for her fine effects: the mildness of that season, the beauty of the sky, the richness of the earth, and the variety of objects, are powerful inducements with the painter to make the proper inquiries for improving his genius and perfecting his art.

But as we cannot see or observe every thing, it is very commendable to make use of other mens studies, and to look upon them as if they were our own. Raphael sent some young men into Greece to design such things as he thought would be of service to him, and accordingly made use of them to as good purpose as if he himself had designed them on the spot: for this, Raphael is so far from deserving censure, that he ought, on the contrary, to be commended; as an example, that painters ought to leave no way untried for improving in their professions. The landscape painter may, accordingly, make use of the works of all those who have excelled in any kind, in order to acquire a good manner; like the bees which gather their variety of honey from different flowers.

*General Remarks on Landscapes.* As the general rules of painting are the basis of all the several kinds of it, we must refer the landscape-painter to them, or rather suppose him to be well acquainted with them. We shall here only make some general remarks on this kind of painting.

I. Landscape supposes the knowledge and practice of the principal rules in *perspective*, in order to maintain probability.

II. The nigher the leaves of trees are to the earth, the larger they are, and the greener; as being aptest to receive, in abundance, the sap which nourishes them: and the upper branches begin first to take the redness

Landscapes. redness or yellowness which colours them in autumn. But it is otherwise in plants; for their stocks renew all the year round, and their leaves succeed one another, at a considerable distance of time, insomuch that nature, employed in producing new leaves to adorn the stock as it rises, does by degrees desert the under ones; which, having first performed their office, are the first that die: but this effect is more visible in some than in others.

III. The under parts of all leaves are of a brighter green than the upper, and almost always incline to the silverish; and those which are wind shaken are known from others by that colour: but if we view them from beneath, when penetrated by the sun's rays, they discover such a fine and lively green as is far beyond all comparison.

IV. There are five principal things which give spirit to landscape, viz. figures, animals, waters, windshaken trees, and thinness of pencilling; to which add smoke, when there is occasion to introduce it.

V. When one colour predominates throughout a landscape, as one green in spring, or one red in autumn, the piece will look either as of one colour, or else as unfinished. We have seen many of Bourdon's landscapes, which, by handling the core one way throughout, have lost much of their beauty, though the situations and waters were very pleasant. The ingenious painter must endeavour to correct, and, as they say, redeem the harsh unsightly colouring of winter and spring by means of figures, waters, and buildings; for summer and autumn subjects are of themselves capable of great variety.

VI. Titian and Carrache are the best models for inspiring good taste and leading the painter into a good track, with regard to forms and colours. He must use all his efforts to gain a just idea of the principles which those great men have left us in their works; and to have his imagination filled with them, if he would advance by degrees towards that perfection which the artist should have always in view.

VII. The landscapes of these two masters teach us a great many things, of which discourse can give us no exact idea, nor any general principle. Which way, for example, can the measures of trees in general be determined, as we determine those of the human body? The tree has no settled proportions; most of its beauty lies in the contrast of its branches, an unequal distribution of boughs, and, in short, a kind of whimsical variety, which nature delights in, and of which the painter becomes a judge when he has thoroughly relished the works of the two masters aforesaid. But we must say, in Titian's praise, that the path he struck out is the surest; because he has exactly imitated nature in its variety with an exquisite taste, and fine colouring: whereas Carrache, though an able artist, has not, more than others, been free from manner in his landscapes.

VIII. One of the greatest perfections of landscape, in the variety it represents, is a faithful imitation of each particular character: as its greatest fault is a licentious practice, which brings us to do things by rote.

IX. Among those things which are painted practically, we ought to intermix some done after nature, to induce the spectator to believe that all are so.

X. As there are styles of thought, so there are also styles of execution. We have handled the two relating to thought, viz. the heroic and pastoral; and find that there are two also with regard to execution, viz. the firm style, and the polished; these two concern the pencil, and the more or less ingenious way of conducting it. The firm style gives life to work, and excuse for bad choice; and the polished finishes and brightens every thing; it leaves no employment for the spectator's imagination, which pleases itself in discovering and finishing things which it ascribes to the artist, though in fact they proceed only from itself. The polished style degenerates into the soft and dull, if not supported by a good opening or situation; but when those two characters meet, the picture is fine. Portraiture.

## Sect. III. *Of Portraiture.*

If painting be an imitation of nature, it is doubly so in a portrait; which not only represents a man in general, but such a one as may be distinguished from all others. And as the greatest perfection of a portrait is extreme likeness, so the greatest of its faults is to resemble a person for whom it was not made; since there are not in the world two persons quite like one another. But before we proceed to the particulars which let us into the knowledge of this imitation, it is necessary, for shortening this part of our subject, to attend to some general propositions.

I. Imitation is the essence of painting: and good choice is to this essence what the virtues are to a man; they raise the value of it. For this reason, it is extremely the painter's interest to choose none but good heads, or favourable moments for drawing them, and such positions as may supply the want of a fine natural.

II. There are views of the natural more or less advantageous; all depends upon turning it well, and taking it in the favourable moment.

III. There is not a single person in the world who has not a peculiar character both in body and face.

IV. Simple and genuine nature is more proper for imitation; and is a better choice than nature much formed, and embellished too artificially.

V. To adorn nature too much is doing it a violence; and the [illegible] which attends it can never be free when its ornaments are not easy. In short, in proportion as we adorn nature, we make it degenerate from itself, and bring it down to art.

VI. Some means are more advantageous than others to come at the same end.

VII. We must not only imitate what we do see in nature, but also what we may possibly see that is advantageous in art.

VIII. Things are valuable by comparison; and it is only by this we are enabled to make a right judgment of them.

IX. Painters easily accustom themselves to their own tints, and the manner of their masters: and after this habit is rooted in them, they view nature not as she really is, but as they are used to paint her.

X. It is very difficult to make a picture, the figures of which are as big as the life, to have its effect near as at a distance. A learned picture pleases the ignorant only when it is at some distance; but judges will

Portraiture. will admire its artifice near, and its effect at a distance.

XI. Knowledge makes work pleasant and easy. The traveller who knows his road, comes to his journey's end with more speed and certainty than he who inquires and gropes it out.

XII. It is proper, before we begin a work, to meditate upon it, and to make a nice coloured sketch of it, for our own satisfaction, and a help to the memory.

We cannot too much reflect on these propositions; and it is necessary to be well acquainted with them, that they may present themselves to our mind, of their own accord, without our being at the trouble to recal them to our memory when we are at work.

There are four things necessary to make a portrait perfect; *air*, *colouring*, *attitude*, and *dress*.

*Of Air.* The air respects the lines of the face, the head attire, and the size.

The lines of the face depend upon exactness of draught, and agreement of the parts; which all together must represent the physiognomy of the person painted in such a manner, that the picture of his body may seem to be also that of his mind.

It is not exactness of design in portraits that gives spirit and true air, so much as the agreement of the parts at the very moment when the disposition and temperament of the sitter are to be hit off. We see several portraits which, though correctly designed, have a cold, languishing, and stupid air; whilst others, less correct in design, strike us, however, at first sight with the sitter's character.

Few painters have been careful enough to put the parts well together: Sometimes the mouth is smiling, and the eyes are sad; at other times, the eyes are cheerful, and the cheeks lank: by which means their work has a false air, and looks unnatural. We ought therefore to remember, that, when the sitter puts on a smiling air, the eyes close, the corners of the mouth draw up towards the nostrils, the cheeks swell, and the eyebrows widen: but in a melancholy air, these parts have a contrary effect.

The eyebrows, being raised, give a grave and noble air; but if arched, an air of astonishment.

Of all the parts of the face, that which contributes most to likeness is the nose; it is therefore of great moment to set and draw it well.

Though the hair of the head seems to be part of the dress which is capable of various forms without altering the air of the face; yet the head attire which one has been most accustomed to creates such a likeness, that we scarce know a familiar acquaintance on his putting on a periwig somewhat different from that which he used to wear. It is necessary therefore, as far as possible, to take the air of the head ornament, and make it accompany and set off that of the face, if there be no reason to the contrary.

As to the stature, it contributes so much to likeness, that we very often know people without seeing their face: It is therefore extremely proper to draw the size after the sitter himself, and in such an attitude as we think fit; which was Vandyke's method. Here let us remark, that, in sitting, the person appears to be of a less free make, through the heaving of his shoulders; wherefore, to adjust his size, it is proper to make him stand for a small time, swaying in the posture we would give him, and then make our observation. But here occurs a difficulty, which we shall endeavour to examine: "Whether it is proper, in portraiture, to correct the defects of nature?"

Colouring.

Likeness being the essence of portraiture, it would seem that we ought to imitate defects as well as beauties, since by this means the imitation will be more complete: It would be even hard to prove the contrary to one who would undertake the defence of this position. But ladies and gentlemen do not much approve of those painters who entertain such sentiments, and put them in practice. It is certain that some complaisance in this respect is due to them; and there is little doubt but their pictures may be made to resemble, without displeasing them; for the effectual likeness is a just agreement of the parts that are painted with those of nature; so that we may be at no loss to know the air of the face, and the temper of the person whose picture is before us. All deformities, therefore, when the air and temper may be discovered without them, ought to be either corrected or omitted in women's and young men's portraits. A nose somewhat awry may be helped, or a shrivelled neck or high shoulders adapted to a good air, without going from one extreme to another. But this must be done with great discretion: for, by endeavouring to correct nature too much, we insensibly fall into a method of giving a general air to all our portraits; just as, by confining ourselves too much to the defects and littleness of nature, we are in danger of falling into the low and tasteless manner.

But in the faces of heroes and men of rank, distinguished either by dignities, virtues, or great qualities, we cannot be too exact, whether the parts be beautiful or not: for portraits of such persons are to be standing monuments to posterity; in which case, every thing in a picture is precious that is faithful. But after whatever manner the painter acquits himself in this point, let him never forget good air nor grace; and that there are, in the natural, advantageous moments for hitting them off.

*Of Colouring.*—Colouring, in portraiture, is an effusion of nature, discovering the true tempers of persons; and the temper being essential to likeness, it ought to be handled as exactly as the design. This part is the more valuable, as it is rare and difficult to hit. A great many painters have come to a likeness by strokes and outlines; but certainly they are few who have shown in colours the tempers of persons.

Two points are necessary in colouring; exactness of tints, and the art of setting them off. The former is acquired by practice, in examining and comparing the colours we see in life with those by which we would imitate it: and the art of those tints consists in knowing what one colour will produce when set by another, and in making good what either distance or time may abate of the glow and freshness of the colours.

A painter who does nothing more than what he sees, will never arrive at a perfect imitation; for though his work may seem, on the easel, to be good to him, it may not appear so to others, and perhaps even to himself, at a distance. A tint which, near, appears disjoined, and of one colour, may look of another at a distance, and be confounded in the mass it belongs to. If you would have your work, therefore, to produce a good

Attitude. good effect in the place where it is to hang, both the colours and lights must be a little loaded; but learnedly, and with discretion. In this point consult Titian, Rubens, Vandyke, and Rembrandt's method; for indeed their art is wonderful.

The tints usually require three times of observation. The first is at the person's first sitting down, when he has more spirit and colour than ordinary; and this is to be noted in the first hour of his sitting. The second is when, being composed, his look is as usual; which is to be observed in the second hour. And the third is when, through tiresomeness by sitting in one posture, his colour alters to what weariness usually creates. On which account, it is best to keep to the sitter's usual tint, a little improved. He may also rise, and take some turns about the room, to gain fresh spirits, and shake off or prevent tiresomeness.

In *draperies*, all sorts of colours do not suit all sorts of persons. In men's portraits, we need only observe great truth and great force: but in women's there must also be charms; whatever beauty they have must appear in a fine light, and their blemishes must by some means or other be softened. For this reason, a white, lively, and bright tint, ought never to be set off by a fine yellow, which would make it look like plaster; but rather by colours inclining to green, blue, or gray, or such others as, by the opposition, may make the tint appear more fleshy than usual in fair women. Vandyke often made a fillemot coloured curtain for his ground; but that colour is soft and brown. Brown women, on the other hand, who have yellow enough in their tints to support the character of fleshiness, may very well have yellowish draperies, in order to bring down the yellow of their tints, and make them look the fresher; and near very high coloured and lively carnations linen does wonders.

In *grounds*, two things are observable; the tone and the colour. The colour is to be considered in the same manner as those of draperies, with respect to the head. The tone must be always different from the mass it supports, and of which it is the ground, that the objects coming upon it may not seem transparent, but solid and raised. The colour of the hair of the head usually determines the tone of the ground; and when the former is a bright chesnut, we are often embarrassed, unless helped by means of a curtain, or some accident of the claro obscuro, supposed to be behind, or unless the ground is a sky.

We must further observe, that where a ground is neither curtain nor landscape, or such like, but is plain and like a wall, it ought to be very much party-coloured, with almost imperceptible patches or stains; for, besides its being so in nature, the picture will look the more grand.

*Of Attitude, or Posture.*—Attitudes ought to suit the age and qualities of persons and their tempers. In old men and women, they should be grave, majestic, and sometimes bold: and generally, in women, they ought to have a noble simplicity and modest cheerfulness; for modesty ought to be the character of women; a charm infinitely beyond coquetry! and indeed coquettes themselves are not to be painted such.

Attitudes are of two kinds: one in motion, the other at rest. Those at rest may suit every person: but those in motion are proper for young people only, and are hard to be expressed; because a great part of the hair and drapery must be moved by the air; motion, in painting, being never better expressed than by such agitations. The attitudes at rest must not appear so much at rest as to seem to represent an inactive person, and one who sits for no other purpose but to be a copy. And though the figure that is represented be at rest, yet the painter, if he thinks fit, may give it a flying drapery, provided the scene or ground be not a chamber or close place.

It is above all things necessary that the figures which are not employed should appear to satisfy the spectator's curiosity; and for this purpose show themselves in such an action as suits their tempers and conditions, as if they would inform him what they really were: and as most people pretend to sincerity, honesty, and greatness of mind, we must avoid in attitudes, all manner of affectation; every thing there must appear easy and natural, and discover more or less spirit, nobleness, and majesty, in proportion to the person's character and dignity. In a word, the attitudes are the language of portraits; and the skilful painter ought to give great attention to them.

But the best attitudes are such as induce the spectator to think that the sitter took a favourable opportunity of being seen to advantage, and without affectation. There is only one thing to be observed with regard to women's portraits, in whatever attitude they are placed; which is, that they sway in such a manner as to give their face but little shade; and that we carefully examine whether the lady appear most beautiful in a smiling or in a serious air, and conduct ourselves accordingly. Let us now proceed to the next article.

Practice in Portraiture. *Of Practice in Portraiture.*—According to De Piles, portraiture requires three different sittings and operations; viz. dead colouring, second colouring, and retouching or finishing. Before the painter dead colour, he must attentively consider what aspect will best suit the sitter, by putting him in different positions, if we have not any settled design before us: and when we have determined this, it is of the last consequence to put the parts well together, by comparing always one part with another; for not only the portrait acquires a greater likeness when well designed, but it is troublesome to make alterations at the second sitting, when the artist must only think of painting, that is, of disposing and uniting his colours.

Experience tells us, that the dead colouring ought to be clean, because of the slope and transparency of the colours, especially in the shades: and when the parts are well put together, and become clammy, they must be judiciously sweetened and melted into each other; yet without taking away the air of the picture, that the painter may have the pleasure of finishing it, in proportion as he draws. But if fiery geniuses do not like this method of scumbling, let them only mark the parts slightly, and so far as is necessary for giving an air.

In dead colouring, it is proper to put in rather too little than too much hair about the forehead; that, in finishing, we may be at liberty to place it where we please, and to paint it with all possible softness and delicacy. If, on the contrary, you sketch upon the forehead a lock which may appear to be of a good taste,

Practice of Vandyke.

and becoming the work, you may be puzzled in finishing it, and not find the life exactly in the same position as you would paint it. But this observation is not meant for men of skill and consummate experience, who have nature in their heads, and make her submit to their ideas.

The business of the second sitting is, to put the colours well in their places, and to paint them in a manner that is suitable to the fitter and to the effect we propose: But before they are made clammy, we ought to examine afresh whether the parts are rightly placed, and here and there to give some touches towards likeness, that, when we are assured of it, the work may go on with greater satisfaction. If the painter understands what he is about, and the portrait be justly designed, he ought as much as possible to work quick; the sitter will be better pleased, and the work will by this means have the more spirit and life. But this readiness is only the effect of long study and experience; for we may well be allowed a considerable time to find out a road that is easy, and such as we must often travel in.

Before we retouch or finish, it is proper to terminate the hair, that, on finishing the carnations, we may be abler to judge of the effect of the whole head.

If, at the second sitting, we cannot do all we intended, which often happens, the third makes up the loss, and gives both spirit, physiognomy, and character.

If we would paint a portrait at once, we must load the colouring; but neither sweeten, nor drive, nor very much oil it: and if we dip the pencil in varnish as the work advances, this will readily enable us to put colour on colour, and to mix them without driving.

The use and sight of good pictures give greater light into things than words can express: What hits one artist's understanding and temper may be disagreeable to another's; and almost all painters have taken different ways, though their principles were often the same.

We are told that a friend of Vandyke's having observed to him how little time he bestowed on his portraits, Vandyke answered, "That at first he worked hard, and took great pains, to acquire a reputation, and also to get a swift hand, against the time he should work for his kitchen." Vandyke's custom is said to have been this: He appointed both the day and hour for the person's sitting, and worked not above an hour on any portrait, either in rubbing in or finishing; so that as soon as his clock informed him that the hour was out, he rose up, and made a bow to the sitter, to signify, that he had done enough for that day, and then appointed another hour some other day; whereupon his servant came to clean his pencils, and brought a fresh pallet, whilst he was receiving another sitter, whose day and hour he had before appointed. By this method he worked on several pictures the same day, with extraordinary expedition.

After having lightly dead-coloured the face, he put the sitter into some attitude which he had before contrived; and on a gray paper, with white and black crayons, he designed, in a quarter of an hour, his shape and drapery, which he disposed in a grand manner, and an exquisite taste. After this, he gave the drawing to the skilful people he had about him, to paint after the sitter's own clothes, which, at Vandyke's request, were sent to him for that purpose. When his disciples had done what they could to these draperies, he lightly went over them again; and so, in a little time, by his great knowledge, displayed the art and truth which we at this day admire in them. As for hands, he had in his house people of both sexes, whom he paid, and who served as models.

This conduct of Vandyke, however, is mentioned rather to gratify the reader's curiosity, than to excite his imitation; he may choose as much of it as he pleases, and as suits his own genius, and leave the rest.

We must observe by the way, that there is nothing so rare as fine hands, either in the design or colouring. It is therefore convenient to cultivate, if we can, a friendship with some women who will take pleasure in serving for a copy: The way to win them is, to praise their beauty exceedingly. But if an opportunity serves of copying hands after Vandyke, it must not be let slip; for he drew them with a surprising delicacy, and an admirable colouring.

Judgment of Tints.

It is of great service to copy after the manners which come nearest to nature; as are those of Titian and Vandyke. We must, at such times, believe them to be nature itself; and, at some distance, consider them as such, and say to ourselves—*What colour and tint shall I use for such a part?* And then, coming near the picture, we ought to examine whether we are right or not; and to make a fixed rule of what we have discovered, and did not practise before without uncertainty.

It is recommended, before we begin colouring, to catch the very first moments, which are commonly the most agreeable and most advantageous, and to keep them in our memory for use when we are finishing: for the sitter, growing tired with being long in the same place, loses those spirits, which, at his first sitting down, gave beauty to the parts, and conveyed to the tint more lively blood, and a fresher colour. In short, we must join to truth a probable and advantageous possibility, which, far from abating likeness, serves rather to set it off. For this end, we ought to begin with observing the ground of a tint, as well what it is in lights as in shadows; for the shades are only beautiful as they are proportioned to the light. We must observe, if the tint be very lively, whether it partake of yellowness, and where that yellowness is placed; because usually, towards the end of the sitting, fatigue diffuses a general yellowness, which makes us forget what parts were of this colour, and what were not, unless we had taken due notice of it before. For this reason, at the second sitting, the colours must be everywhere readily clapped in, and such as appear at the first sitting down; for these are always the finest.

The surest way to judge of colours is by comparison; and to know a tint, nothing is better than to compare it with linen placed next it, or else placed next to the natural object, if there is occasion.—We say this only to those who have little practised nature.

The portrait being now supposed to be as much finished

Different Methods of Painting.

finished as you are able, nothing remains, but, at some reasonable distance, to view both the picture and sitter together, in order to determine with certainty, whether there is any thing still wanting to perfect the work.

## Sect. IV. *Of Theatrical Decorations; the Designs for Furniture, Embroidery, Carriages, &c.*

*Of Theatrical Decorations.*—This is a particular art which unites several of the general parts of painting with the knowledge of architecture, perspective, &c. They who apply themselves to it would do well to design their decorations by day, and to colour them by candle light, as they will be much better able to judge of the effect of a painting intended to be viewed by that light. It is proper also to caution the young painter to avoid, as much as possible, the uniting the imitations of nature with nature itself; that is, he should not introduce with his decorations living horses, or other animals, real fountains or cascades, trees, or statues, &c. For such combinations are the effect of ignorance and a bad taste; they are the resource of painters of little ability; they discover a sterility of invention, and produce great inconvenience in the representation. Those pieces which they call moving pictures, where the painted landscape remains immoveable, and the figures move by means of springs, form a part of these decorations; and there are some of them, as those of Antwerp and Ghent, that have a pleasing effect.

The designs for *furniture, carriages, porcelain*, and other branches of manufacture, form also a very important article of painting in general, and of academy painting in particular. This is a distinct branch of the art; and without doubt not the least useful of its parts, as it concurs so essentially to the success of manufactures, and consequently to the prosperity of a state: and it is an art, to which it were much to be wished that youth of ability and invention would apply themselves. See the articles Japanning and Porcelain.

## Sect. V. *Enumeration of the different Methods of Painting, or the different Means and Materials that Painters make use of to imitate all visible Objects on a plane Superficies.*

Those now in practice are,

1. Painting in oil; which is preferable to all other methods, as it is more susceptible of all sorts of expressions, of more perfect gradations of colours, and is at the same time more durable.

2. Mosaic painting; an invention truly wonderful; it is composed of a great number of small pieces of marble of different colours, joined together with stucco. The works of this kind are made principally at Rome, where this art has been carried so far as to resemble the paintings of the greatest masters; and of these are made monuments for the latest posterity.

3. Painting in fresco; which is by drawing, with colours diluted with water, on a wall newly plastered, and with which they so incorporate, that they perish only with the stucco itself. This is principally used on ceilings.

4. Painting in water colours; that is, with colours mixed with water and gum, or paste, &c.

5. Miniature painting; which differs from the preceding as it represents objects in the least discernible magnitudes.

6. Painting in crayons; for which purpose colours, either simple or compound, are mixed with gum, and made into a kind of hard paste like chalk, and with which they draw on paper or parchment.

7. Painting in enamel; which is done on copper or gold, with mineral colours that are dried by fire, and become very durable. The paintings on the porcelain of China and Europe, on Delft ware, &c. are so many sorts of enamel.

8. Painting in wax, or encaustic painting: This is a new, or rather an old invention renewed, in which there are in France performances highly pleasing. It is done with wax mixed with varnish and colours.

9. Painting on glass; of which there are various kinds.

See all the articles here enumerated, explained in the order of the alphabet. On one of them, however, some additional observations may here be subjoined.

Fresco.

### § 1. *Of Painting in Fresco.*

Of all kinds of painting fresco is the most ancient, the most durable, the most speedily executed, and the most proper to adorn great buildings. It appears, that the fragments of ancient painting handed down to us by the Romans are all in fresco. Norden, quoted by Winkleman, speaks of the ruins of Egyptian palaces and temples, in which are colossal paintings on walls 80 feet high. The description which those authors have given of these paintings, of the prepared ground, and of the manner in which the colours have been employed, &c. shows plainly that they have been executed in fresco.

The stability of fresco is demonstrated by the existence of those fragments of the highest antiquity. There are no other kinds of painting which could equally have resisted the injuries of the weather, the excessive aridity of certain climates, the moisture of subterraneous situations, and the encroachments of barbarians.

There are different opinions concerning the climate most proper to preserve this kind of painting. "It is observed (says Felibien), that the colours in *fresco* fade sooner in Italy and Languedoc than at Paris; perhaps from less heat in the last mentioned place, or better lime." M. Falconet contradicts this assertion in his notes on Pliny, Vol. I. p. 223. of his miscellaneous works, published at Paris 1787. Painting in fresco, according to this author, is longer preserved in dry and warm, than in northern and moist climates. However opposite the sentiments of these two authors may appear to be, it is possible to reconcile them, when we consider, that the exposure to a burning sun is capable of operating a great change of the colours on the one hand, and that the frost in a cold climate inevitably destroys the paintings of fresco on the other. Frost is capable of bursting stones, of corroding the petrified veins of earth in the heart of coloured marble, and in short, nothing can resist its destructive operation.

These observations on fresco paintings lead us to conclude, that the choice of place, when they are without doors, is of the greatest importance. In countries where

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where there is little or no frost, an exposure to the north is the most favourable; and in cold climates a western exposure should be made choice of, because the first rays of the rising sun have a very pernicious effect after frost. We are not, however, wholly to adopt the sentiment of M. Falconet with regard to the pernicious effects of moisture on fresco paintings: for, 1. The ancient paintings recovered from moist places, in which they were buried for many ages, have, under enormous heaps of earth, preserved all their colours. Those from the ruins of Herculaneum have been observed, on the contrary, to lose their colours in a short time after they have been dried by the exterior air. 2. The mortar which composes the ground of this painting is not destroyed in our rainy climates. It is necessary frequently to use powder in removing pieces of this mortar, which are now found to obstruct some buildings in Paris.

After the choice of place, the choice of materials is the next thing of importance in executing fresco. To make it durable, the ground is the object of chief attention; and to make this perfect, the mortar used by the ancients, now unknown, would be necessary.

It is easy to perceive, that a minute detail of forms, an extensive mixture and gradation of tints, and the merit of a delicate and gentle touch, can make no part of the excellencies of this kind of painting. It cannot bear a close examination like a picture in oil. There is always something dry and rough which displeases. An artist who would flatter himself with success in a fresco placed near the eye would be grossly deceived: a common spectator would find it coarse and badly finished.

Fresco is chiefly employed in palaces, temples, and public edifices. In these vast places no kind of painting can be preferred to it; large, vivid in its strokes, and constantly fresh, it enriches the architecture, animates it, and gives relief to the eye from the repetition of the same forms, and the monotony of colour in a place where coloured marbles and bronzes are not employed. Still more a fine fresco gives the greatest effect to a lofty building, since this building serves as a frame and support to this enchanting art, which fixes the attention of every person of sensibility and taste.

We shall afterwards have occasion to show the manner of executing fresco, as well as the nature and application of the colours employed in it: it is necessary to demonstrate here, that it has a freshness, splendour, and vigour not to be found in oil or water colours.

A known principle in all kind of painting is, that the colouring is more perfect in proportion as it approaches to the lights and shades in nature. As colours applied to any subject can never reach this degree of perfection, the allusion which painters produce consists in the comparison and opposition of the tones of colours among themselves.

If the white of the finest and purest oil appears heavy and gray, compared with great lights in natural whites, it follows, that, in order to copy them with fidelity, the tones which follow the first white must be degraded in an exact proportion. Thus it is necessary that the shades of a picture be considerably deeper than those of the model; especially if, from the greatest lights to the browns, one hath proportionally followed the distance which is found between the colours on the pallet and the tones of the object copied.

Now if the white of fresco be infinitely more bright than that of oil, the same effect will be obtained in a brown tone. On the other side, if it constantly happens that the brown tones of fresco are much more vigorous than those of water colours, and equal even to the browns of oil itself, it is certain that it possesses a splendour and vigour more extensive than any other kind of painting. Thus in the hands of an artist who is well acquainted with the colours fit for fresco, it is more susceptible of the general effect, and more capable than any other kind of giving projection and the semblance of life to the figures.

If we were to inquire why painting in fresco is now scarcely or never practised, we should perhaps ascribe it to the great talents required to execute it. "Many of our painters (says Vasari in his Treatise on Painting) excel in oil or water colours, and yet fail in fresco; because of all kinds this requires the greatest strength of genius, boldness in the strokes, and resolution." If in an age abounding in great masters, it was difficult to excel in this kind, it must be much more so in ours; but we should not require the characters of sublimity and style to which men were accustomed in the time of Vasari.

We should execute in fresco as we do in oils; for Italy herself, along with Michael Angelo and Zuicharo, had Cortonni, Giardano and Francischini as middling fresco painters. And in France, Lafosse, Bon-Boulogne, and Perur, performed several works in fresco which might be imitated by the painters of our times. But let us proceed to the real causes for abandoning this art. These proceed from the want of knowledge and taste in the persons who employ the artists, and from the manners of the age. As a pleasant or licentious conceit, unfinished colouring, and bold effects of shade, are the chief objects of consideration, a very smooth painting enlivened by gentle touches completely gratifies the person who pays the price; and therefore the philosophical principles of the art, which require study, are not cultivated.

We shall now attend to the mechanical process of this useful and beautiful kind of painting. Before painting, it is necessary to apply two layers. If the wall on which you are to paint is of brick, the layer is easily applied; but if it is of free stone closely united, it is necessary to make excavations in the stone, and to drive into them nails or pegs of wood in order to hold the first layer.

The first layer is made of good lime and a cement of pounded brick, or, which is still better, river sand: this latter forms a layer more uneven, and better fitted to retain the second smooth and polished layer applied to its surface.

There should be experiments to discover a layer still more compact, and more independent of the variations of the air; such for example, as covers the aqueducts and ancient reservoirs constructed by the Romans in the neighbourhood of Naples.

Before applying the second layer, or what you are to paint, it is necessary that the first be perfectly dry; for there issues from the lime, when it is moist, a smell both disagreeable and pernicious to the artist.

When

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when the firſt layer is perfectly dry, it is wet with water in proportion to its dryneſs, that the ſecond layer may the more eaſily incorporate with it.

The ſecond layer is compoſed of lime, ſlaked in the air, and expoſed for a year, and of river ſand, of an equal grain, and moderately fine.

It requires an active and intelligent maſon to apply this layer, as the ſurface muſt be altogether equal. The operation is performed with a trowel; and the operator requires to have a ſmall piece of wood to take away the large grains of ſand, which, remaining, might render the ſurface uneven.

To give a fine poliſh to this layer, one ought to take a ſheet of paper, apply it to the wall, and paſs and repaſs the trowel over the paper. By this means the little inequalities which hurt the exactneſs of the ſtroke, and which produce falſe appearances at a diſtance, are entirely ſmoothed.

The cruſt muſt not lay more than the painter can finiſh in a day, as this kind of painting muſt be executed on a freſh ground.

The layer being thus prepared, the painter begins his operation; but as painting in freſco muſt be executed rapidly, and as there is no time to retouch any of the ſtrokes, the painter, as we have obſerved under the article Fresco, takes care to provide himſelf with large cartoons, on which he has drawn, with exactneſs, and in their full ſize, the figures which he is to paint, which leaves him nothing to do but to copy them on the wall.

The cartoons are compoſed of ſeveral ſheets of large paper paſted one on another, neither too thick nor too ſlender.

The painter traces the tracks of the figures on the plaſter, by paſſing a ſteel point over the tracks in the cartoons, or in pricking them.

Having in this manner attained an exact and ſpeedy drawing, it now remains to execute the painting.

But it is eſſential, when one wiſhes to finiſh any ſmall work of this kind, in the firſt place to be informed of the proper colours, and of thoſe which cannot be uſed.

In general, the colours which are extracted from earths, and thoſe which have paſſed through the fire, are the only ones which can be employed in this kind of painting.

The colours are white, made of lime, the white of egg ſhells, ultramarine, the black of charcoal, yellow ochre, burnt vitriol, red earth, green of Verona, Venetian black, and burnt ochre.

There are others which require to be uſed with great precaution, ſuch as enamel blue, cinnabar, and white marble duſt.

When enamel blue is uſed, it requires to be applied inſtantaneouſly, and when the lime is very moiſt, otherwiſe it does not incorporate with the plaſter; and if one retouch with this colour, it muſt be done an hour or more after the firſt application, to increaſe its luſtre.

With regard to the white marble duſt, it is ſubject to turn black if it be not mixed up with a convenient quantity of white lime.

Cinnabar which has a ſplendour almoſt ſuperior to all other colours, loſes it almoſt entirely when mixed with lime. At the ſame time, it may be employed in places not expoſed to the air, with a little degree of care in the preparation. Reduce a quantity of the pureſt cinnabar to powder, put it into an earthen veſſel, and pour lime water on it for two or three times. By this proceſs the cinnabar receives ſome impreſſion of lime water, which makes it capable of being employed in freſco painting.

Elydoric Painting.

One of the beſt colours, and the one moſt uſed in freſco for the gradation of tints, and for giving the requiſite tone, is white of lime. This white is prepared by mixing lime ſlaked long before with good water. The lime depoſites a ſediment at the bottom of the veſſel; when the water is poured off, this ſediment is the white of lime.

Another kind of white might be uſed, the effects of which would be known by experience, namely, the white of egg ſhells. To prepare this white, one muſt take a great quantity of ſhells of eggs, which muſt be pounded and boiled in water along with a quantity of quicklime; after this they are put into a ſtrainer, and waſhed repeatedly with fountain water.

The ſhells are again pounded until the water employed for that purpoſe become pure and limpid; and when they are in this manner reduced to powder, this powder is grinded in water, and formed into ſmall pieces, and dried in the ſun.

All the different kinds of ochres make excellent colours for freſco, and take different ſhades, being previouſly burned in iron cheſts.

With regard to the Naples yellow, it is dangerous to uſe it where the painting is much expoſed to the air. The blacks of charcoal, of peach ſtones, and of vine twigs, are good: but that extracted from bones is of no value.

Roman vitriol gathered at the furnaces, and which is called *burnt vitriol*, grinded afterwards in ſpirit of wine, reſiſts the air extremely well when employed in lime. There is alſo a red extracted from this preparation ſomewhat like that produced from lac.

This colour is very proper for preparing the layers to be coloured with cinnabar; and the draperies painted with theſe two colours will vie in ſplendour with thoſe painted with fine lac in oil.

The ultramarine is the moſt faithful colour; and it not only never changes, but it communicates this precious quality to thoſe colours with which it is mixed.

The manner of employing thoſe colours, is to grind them in water, and to begin by arranging them into the principal tints you are to employ: theſe are afterwards put into pots; and it is neceſſary to uſe a great many pallets raiſed at the edges, to form the intermediate ſhades, and to have under your eye all the ſhades you require.

As all the tints, except burnt ochre, violet, red, and blacks of all kinds, are apt to become clear, the painter muſt have beſide him ſome pieces of brick or new tile very dry. A daſh of the colours is applied to one of theſe with the pencil before uſing them; and as tile inſtantaneouſly imbibes the water, one perceives what the ſhade will be after the freſco is dry.

### § 2. *Elydoric Painting, invented by M. Vincent of Montpetit.*

This new kind of painting is little known, and capable of great improvement.

Its

Elydoric Painting.

Its principal advantages are, that the artist is able to give the greatest finishing possible to small figures in oil; to add to the mellowness of oil painting, the greatest beauty of water colours in miniature, and to do it in such a manner that it appears like a large picture seen through a glass which diminishes objects.

This kind of painting takes its name from two Greek words expressive of *oil* and *water*; because these two liquids are employed in the execution. The following is the manner of proceeding: A piece of very fine linen, or of white taffety, is fixed with starch, in the most equal manner possible, on pieces of glass about two inches square, the angles of which are blunted in order that the cloth may cover them neatly and without wrinkles.

When these pieces of cloth are sufficiently dry, a layer composed of white lead finely grinded, and oil of pinks or of poppies, the whitest that can be found, is applied to them with a knife. When this layer is dry enough to admit of scraping, more may be applied if necessary.

As it is of the greatest importance for the preservation of this kind of painting, that the different layers be purged of oil, in order that they may imbibe the colours applied to them, it is necessary that their surface be very smooth, very dry, and very hard.

The artist is next provided with a circle of copper nearly two inches in diameter, one-fourth of an inch in height, extremely thin, and painted on the inside with black. This circle is employed to contain the water on the surface of the picture.

The preference is given to water distilled from rain or snow; because ordinary water, from the salts which it contains, is pernicious to this kind of painting.

It is necessary also to observe, that the colours must be grinded between two oriental agates, most carefully preserved from dust, and mixed with oil of poppies, or any other siccative oil which has been extracted without fire, and pure as water.

All the colours being grinded, they are placed in a small heap on a piece of glass, which is covered with distilled water in a tin box.

When the materials are thus prepared, the subject is slightly traced on one of the pieces of cloth abovementioned with a lead pencil.

The tints are formed on the pallets from the heaps of colours under the water, and the pallet placed as usual on the left arm with the thumb through the aperture.

The picture is held between the thumb and fore finger, supported by the middle, and the necessary pencils between the third and little fingers. The hand is supported on the back of a chair, that there may be full liberty of bringing the work near, or keeping it at a distance from the eye.

The pencils are cleaned with the essence of rectified turpentine.

After having made the rough draught with the colours still fresh, the circle of copper, which ought to surround the picture, is fitted exactly to the surface.

The distilled water is poured within this circle to the height of one-eighth part of an inch; and the body is leaned forward till the sight fall perpendicularly on the object.

The third finger of the right hand must rest on the internal right angle of the picture.

The artist, with a fine and firm pencil, runs over the first draught, to give colours to the weak places, and to soften those which appear too strong.

As soon as the oil swims on the top, the water is poured off, and the picture is carefully covered with a watch glass, and dried in a box with a gentle heat.

When it is sufficiently dry, to be scraped almost to a level with the knife; the above operation is renewed till the artist is satisfied with his work.

It is in this last work that the artist feels all the advantage of this new method for finishing.

The water poured on the picture discovers all the faults of the pencil, gives facility in searching into the bottom of the shades, and the power of correcting the work and of rendering it perfect.

When the work is finished, it is put under a crystal, where there is no admission of external air, and dried with a gentle heat.

## PART III. Of Economical Painting.

### SECTION I.

THE object of this Part is to give an account of some mechanical proceedings in certain kinds of painting, calculated to preserve and embellish the walls of houses and furniture. This branch of the art extends to every part of architecture. The whole building becomes the workshop of the artist; the stairs, the ballustrades, the sashes, the doors, and the railing of all kinds, occupying his first care, and then the ceiling and wainscotting.

The artist gives to all his subjects a chosen and uniform tint; but he has it in his power to vary the colours on different parts of the building in such a manner as to produce the most pleasing effects.

22 Of the utensils for this kind of painting.

Among the utensils of the painter, it is needless, but for rendering the article complete, to mention brushes and pencils of all sizes as absolutely necessary.

The brushes are made of boars bristles, or of hair with a mixture of bristles; they ought to be straight, very smooth, and of a round form. Half an hour before they are used, it is proper to soak them in water, in order to swell the wood of the handle, and prevent the hairs from falling off; after this they may be applied to all purposes, either in water colours or in oil; but it may be observed, that for the former they require less softening.

The pencils are made of badgers hair, or any fine hairs enchased in the pipes of quills of all sizes.

The vessel wherein the pencils are cleaned is made of copper or of tin, smooth below, rounded at the ends, and divided into two parts by a thin plate in the middle. The oil, or the substance with which the pencil is cleaned, is contained in one of the divisions.

The pallet is made of the wood of the pear or apple tree, of an oval or square shape, very slender, but sometimes

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somewhat thicker at the centre than at the extremities. A hole is made in one of its sides sufficiently large to admit the thumb of the workman.

When the pallet is new, it is covered with oil of walnuts; and as often as it dries, the operation is repeated, till it be fully impregnated; it is afterwards polished, and finally rubbed with a piece of linen dipped in oil of common nuts.

The painter's knife is a thin flexible plate, equally slender on both sides, rounded at one extremity, and the other fixed into a handle of wood.

All the vessels employed to hold the colours should be varnished; a precaution necessary to prevent their drying too quickly.

23 Of grinding and diluting the colours.

To grind, is to reduce to powder the substances which give colours on a piece of marble or any hard stone by means of water, oil, or essence.

To dilute, is to impregnate a liquid with a tint in such a manner as to make it capable of being applied by a brush.

When the materials are grinded in water, it is proper to dilute them in size made from parchment. If they are diluted in spirit of wine, there must be no more diluted than what serves the immediate occasion, as colours prepared in this manner dry very rapidly.

Colours grinded in oil are sometimes diluted with pure oil, more frequently with oil mixed with essence, and commonly with the pure essence of turpentine; the essence makes the colours easy to work. Those prepared in this manner are more solid, but they require more time to dry.

When colours are grinded with the essence of turpentine, and diluted in varnish, as they require to be immediately applied, it is necessary to prepare a small quantity at a time. This preparation of colours gives greater brilliancy, and dries more speedily, than those prepared in oil; but they require more art to manage them.

They grind colours or coloured substances with a mullet, which is employed on the stone till they become a very fine powder. The operation is facilitated by moistening them from time to time with a little water, and by collecting them under the mullet with the knife. They are afterwards laid in small heaps on a sheet of white paper, and allowed to dry in a situation not exposed to dust. Those who grind white lead have a stone for the purpose, as this colour is very easily tarnished. In executing this part well, it is necessary to grind the colours equally and moderately; to grind them separately, and not to produce a tint by mixture till the colours are well prepared.

Dilute no more at a time than what you have occasion to employ, to prevent them from growing thick.

In grinding the colours, put in no more liquid than what is necessary to make the solid substances yield easily to the mullet; the more the colours are grinded, they mix better, and give a smoother and more agreeable painting.

It is also necessary to give all attention to the grinding and diluting of colours, that they may be neither too thick nor too thin.

## Sect. II. *Application of Colours.*

1. Prepare only the quantity necessary for the work you undertake, because they do not keep long; and those which are newly mixed are more vivid and beautiful.

Application of Colours.

2. Hold the brush straight before you, and allow only the surface to be applied to the subject: if you hold it inclined in any other direction, you will run the hazard of painting unequally.

3. It is necessary to lay on the colours boldly, and with great strokes; taking care at the same time to spread them equally over the surface, and not filling up the moulding and carved work. If this accident should happen, you must have a little brush to clean out the colours.

4. Stir them frequently in the vessel, that they may preserve always the same tint, and that no sediment may remain at the bottom.

5. Take care not to overcharge the brush with the colour.

6. Never apply a second layer till the first or preceding one be perfectly dry; which it is easily known to be when, in bearing the hand gently over it, it does not adhere.

7. In order to render this drying more speedy and uniform, make always the layers as thin as possible.

8. Before painting, it is necessary to prime the subject; that is, to give it a layer of size, or of white colouring oil, to fill up the pores, and render the surface smooth: by this means fewer layers of colour or of varnish are afterwards necessary.

9. Every subject to be painted or gilded ought to have first a white ground; this preserves the colours fresh and vivid, and repairs the damage which they occasionally receive from the air.

### § 1. *Of Painting in Water Colours.*

To paint in water colours, is to do it in those which are grinded in water and diluted in size. There are three kinds of this painting; namely *common*, the *varnished*, and that which is called *king's white;* but before entering on these, it is necessary to make some preliminary observations.

1. Take care that there be no grease on the subject; and if there be, scrape it off, or clean it with a lye, or rub the greasy part with garlic and wormwood.

2. Let the diluted colour fall in threads from the end of the brush when you take it out of the vessel; if it adheres to it, it is a proof that it wants size.

3. Let all the layers, especially at the beginning, be laid on very warm, provided that the liquid be not boiling, which would effectually spoil the subject; and if on wood, expose it to crack. The last layer, given immediately before the varnish, is the only one which ought to be applied cold.

4. In very fine work, where it is necessary to have beautiful and solid colours, the subjects are prepared by size and proper whites, which serve as a ground to receive the colour, and render the surface very equal and smooth.

5. Whatever colour is to be laid on, the white ground is the best, as it assimilates most easily with the painting, which borrows always something of the ground.

6. If knots of wood are found in the subject, it is necessary to rub them with garlic, to make the size adhere.

Application of Colours.

To make the following details sufficiently plain, we shall take the measures to which the quantity of colours are applied at fathoms; that is to say, six feet in height by six feet in breadth. We shall afterwards fix the quantity of materials, and of liquids, necessary to cover this surface. This, however, cannot be exactly defined; as some subjects imbibe the colours much more than others. The manner of employing them also makes a difference; as habit enables one to manage them to greater advantage than another. And it is also to be observed, that the first layer will consume more than the second; and that a prepared subject requires less than one which has not been so.

When we speak of a fathom, it must be understood of a smooth and equal surface; for if the wood is varied with mouldings and carving, there must be a difference in the quantity of colours. In general it requires about a pound of colours to paint a square fathom in water colours. In making up this quantity, take three-fourths of colours grinded in water, and one-fourth pound, or six ounces, of size to dilute it.

### § 2. *Of Painting in Common Water Colours.*

Works which require no great care or preparation, as cielings and staircases, are generally painted in common water colours, *i. e.* with earths infused in water and diluted in size.

For a common white kind of this painting, steep Spanish white moderately pounded in water for two hours. Infuse a proper quantity of the black of charcoal in water for the same space of time; mix the black and white in the proportion that the tint requires; afterwards mix them up with a pretty strong size, sufficiently thick and warm, and apply them to the subject in as many layers as may be thought necessary. It requires about two pounds of white in a pint of water, and a quantity of black in proportion to the tint, together with a part of size, to cover a square fathom. If this be employed on old walls, they must be well scraped, the dust brushed off with a hair besom, and washed carefully with lime water. If on new plaster, the colours require more size.

All kinds of colours may be grinded in water only when the tint is made; and when they have been infused in water, they must be mixed up with size.

### § 3. *Walls done with the White* Des Carmes.

The white *des carmes* is a manner of whitening interior walls, whereby they are rendered extremely beautiful.

1. Procure a quantity of the very best lime, and pass it through fine linen; pour it into a large tub, furnished with a spigot at the height equal to that which the lime occupies: fill the tub with clear fountain water; beat the mixture with great pieces of wood, and then allow it to settle for 24 hours.

2. Open the spigot, allow the water to run off, supply the tub with fresh water, and continue this operation for several days until the lime receives the greatest degree of whiteness.

3. When you allow the water finally to run off, the lime will be found in the consistency of paste; but with the quantity you use it is necessary to mix a little Prussian blue or indigo to relieve the brightness of the white, and a small quantity of turpentine to give it brilliancy. The size proper for it is made of glove leather, with the addition of some alum; and the whole is applied with a strong brush in five or six layers to new plaster.

4. The wall is strongly rubbed over with a brush of hogs bristles after the painting is dry; which gives it its lustre and value, and which makes it appear like marble or stucco.

### § 4. *Of Badegeon.*

Badegeon is a pale yellow colour applied to plaster to make it appear like free stones. It gives to old houses and churches the exterior of a new building, by assuming the colour of stones newly cut.

1. Take a quantity of lime newly killed.

2. Add to it half the quantity of what the French call *sciure de pierre*, in which you have mixed of the ochre of *rue*, according to the colour of the stone you intend to imitate.

3. Steep the whole in a pale of water, in which is melted a pound of rock alum. When the *sciure de pierre* cannot be obtained, it is necessary to use a greater quantity of ochre *de rue*, or of yellow ochre, or grind the scales of the stone de St Leu; pass it through a sieve: and along with the lime it will form a cement, on which the weather will scarcely make any impression.

### § 5. *Of Cielings and the Roofs of Rooms.*

When the cielings or roofs are new, and you wish to whiten them, take white of Bougival, to which add a little of the black of charcoal to prevent the white from growing reddish: infuse them separately in water; mix the whole with half water and half size of glove leather, which being strong would make the layer come off in rolls if it were not reduced with water. Give two layers of this tint while it is lukewarm.

If the roof has been formerly whitened, it is necessary to scrape to the quick all the remaining white; then give it two or three layers of lime to ground and whiten it: Brush it carefully over; and give it two or three layers of the white of Bougival prepared as before.

### § 6. *Of Colouring the backs of Chimneys with Lead Ore.*

Clean them with a very strong brush, and carefully rub off the dust and rust; pound about a quarter of a pound of lead ore into a fine powder, and put it into a vessel with half a pint of vinegar; then apply it to the back of the chimney with a brush: When it is made black with this liquid, take a dry brush, dip it in the same powder without vinegar, and dry and rub it with this brush till it become shining as glass.

### § 7. *Of Varnished Water Colours.*

The advantages of this kind of painting are, that the colours do not fade; that they reflect the light; that they give no offensive smell, but permit the places to be inhabited as soon as finished; and that the varnish preserves the wood from insects and moisture.

To make a fine varnish on water colours, seven principal operations are necessary; namely, to size the wood, to prepare the white, to soften and rub the subject, to clean the moulding, to paint, to size, and to varnish.

To

Application of Colours.

24 First operation. To size the wood is to give one or two layers of size to the subject which you intend to paint.

Take three heads of garlic and a handful of wormwood leaves; boil them in three pints of water till they are reduced to one; pass the juice through a linen cloth, and mix it with a pint of parchment size; add half a handful of salt and half a pint of vinegar; and boil the whole on the fire.

Size the wood with this boiling liquor; allow it to penetrate into the carved and smooth places of the wood, but take care at the same time to take it as clean off the work as possible, or at least to leave it at no place thicker than another. This first sizing serves to fill up the pores of the wood, and to prevent the materials afterwards from collecting in a body, which would cause the work to fall off in scales.

In a pint of strong parchment size, to which you have added four pints of warm water, put two handfuls of white Bougival, and allow it to infuse for the space of half an hour.

Stir it well, and give a single layer of it to the subject very warm but not boiling, equally and regularly laid on, and dashed with repeated strokes of the brush into the mouldings and carved work.

25 Second operation. To prepare the white, take a quantity of strong parchment size, and sprinkle lightly over it with the hand, Bougival white, till the size be covered with it about half an inch in thickness; allow it to soak for half an hour as near the fire as to keep it milk warm: and then stir it with the brush till the lumps are broken and it be sufficiently mixed.

Give seven, eight, or ten layers of this white, or as many as the nature of the work or the defects in the wood shall render necessary, giving more white to the parts which require to be softened; but in general, the layers must be equal both with regard to the quantity of the white and the strength of the size.

The last layer of the white ought to be clearer than the rest, which is made by adding water. It must be applied more slightly, taking care with small brushes to cover all the difficult places in the mouldings and carved work. It is necessary also, between the drying of the different layers, to fill up all the defects with white mastich and size.

26 Third operation. To soften, is to give to the subject after the whitening a smooth and equal surface, and to rub it over with a pumice stone.

The wood being dry, take little pieces of white wood and of pumice stone, grinded for the purpose into all necessary forms, either for the panels or the moulding.

Take cold water, heat being destructive of this kind of work; in summer it is common to add a little ice. Soften the wall with a brush, but only as much at a time as you can easily work, as the water might dilute the white and spoil the whole: Then smooth and rub it with the pumice stones and with the small pieces of wood. Wash it with a brush as you smooth it, and rub it over with a piece of new linen, which gives a fine lustre to the work.

27 Fourth operation. The mouldings and carved work are cleaned with an iron; and the only thing to be attended to in the operation is not to raise the grain of the wood.

The subject thus prepared is ready to receive the colour you intend to give it. Choose your tint; suppose a silver colour.

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28 Fifth operation. Grind white ceruse and Bougival white separately in water, of each an equal quantity, and mix them together.—Add a little blue of indigo and a very small quantity of black of charcoal from the vine tree very fine, grinded also separarely, and in water; more or less of the one or other gives the tint you require.—Dilute this tint in strong parchment size; pass it through a bolting cloth of silk very fine, and lay the tint on your work, taking care to spread it very equally; and then give it two layers, and the colour is applied.

29 Sixth operation. Make a weak, beautiful, and clean size; stir it till it cools; strain it through a fine cloth, and give two layers to the work with a soft painting brush, which has been used, but which you have been careful to clean. Take care not to choke up the mouldings nor to lay on the size thicker on one place than another, and spread it over the work very slightly, otherwise you will dilute the colours, and occasion undulations in the painting.

The beauty of the work depends on this last sizing; for if any part is omitted, the varnish will penetrate into the colours and give it a darker shade.

30 Seventh operation. When the sizing is dry, lay on two or three layers of spirit of wine varnish, taking care that the place on which you lay it be warm, and the work is finished.

### § 8. *Of the King's White.*

This derives its name from the use of it in the apartments of the French king. It is in all respects conducted like the former, except that there is only a small quantity of indigo, to take the yellow from the white, without any black of charcoal, and without varnish.

This white answers extremely well for apartments which are seldom used; but otherwise it spoils easily, especially in bedchambers. It is the best white where there is any kind of gilding; and in this case it receives a little varnish.

## Sect. III. *Of Painting in Oil Colours.*

To paint in oil is to apply to all sorts of subjects, as walls, wood, cloths, and metals, coloured earths grinded and diluted in oil. The ancients are thought to have been ignorant of this art, and the honour of the discovery is generally ascribed to John Van Eyck a Flemish painter. The secret is nothing more than substituting oil in place of water in grinding and diluting colours.

By means of oil the colours are longer preserved; and not drying so speedily, they give painters longer time to smooth, finish, and retouch, their works; the colours being more marked, and mixing better together, give more distinguishable tints, and more vivid and agreeable gradations, and the colouring is more sweet and delicate.

The painting in oil consists of two kinds, namely, of that in simple oil and of that in polished oil varnish.

### § 1. *Observations on Painting in Oil.*

1. When bright colours, as white or gray, are grinded and diluted in oil, it is necessary to make use of the oil

Painting in Oil Colours.

of walnuts; but if the colours be dark, such as chesnut, or olive, or brown, you must make use of pure linseed oil.

2. When the colours are grinded and diluted in oil, they must be laid on cold except on a new or moist plaster, which requires them to be boiling.

3. Every colour diluted in pure oil, or in oil mixed with essence, ought to fall in threads from the end of the brush.

4. Take care to stir from time to time your colour before taking it up on the brush, that it may preserve an equal thickness, and consequently the same tone. Notwithstanding the precaution of stirring, if it is found to be thicker towards the bottom, it will be necessary to pour in from time to time a little oil.

5. In general, every subject which is painted in oil ought first to receive one or two layers of white ceruse, grinded and diluted in oil.

6. When the painting is exposed to the air, as in doors, windows, and other works, which cannot be varnished, it is necessary to make these layers with pure oil of walnuts, mixed up with about one ounce of essence to a pound of colours; more would make the colours brown, and occasion them to fall off in dust; but this quantity prevents the sun from blistering the work.

7. In subjects on the inside of the house, or when the painting is varnished, the first layer ought to be grinded and diluted in oil, and the last diluted with pure essence.

8. If copper or iron, or other hard substances, are to be painted, it is necessary to mix a little essence with the first layers, to make the oil penetrate into them.

9. When there are many knots in the subject, as is particularly the case with fir wood, and when the colour does not easily take impression on these parts, it is necessary, when you paint with simple oil, to lay on a little oil mixed with litharge on the knots. If you paint with polished oil varnish, it is necessary to apply a hard tint, which we shall have occcasion to speak of afterwards. A single layer well applied is generally sufficient to give a body to the wood, and make the other layers apply easily.

10. There are colours, such as what the French call *stils-de-grain*, black of charcoal, and especially bone and ivory blacks, which are difficult to dry when grinded in oil. To remedy this inconveniency, the following siccatives are mixed with the colours, to make them dry, viz. litharge both of the silver and gold colour, vitriol or copperas, and what is called *siccative oil*.

§ 2. *Observations on the Siccatives.*

1. Do not mix the siccatives with the colours till they are to be employed, otherwise it will thicken them.

2. Mix it only in very small quantities in tin, wherein there is white lead or ceruse, because those colours are siccative of themselves, especially when they are diluted in essence.

3. In painting which is to be varnished, give the siccative only to the first layer, and allow the other layers, in which there is essence, to dry of themselves.

4. In dark colours in oil, give to every pound of colours in diluting them half an ounce of litharge; to bright colours, a drachm of white copperas grinded in walnut oil.

5. When in place of litharge or copperas the siccative oil is employed, it requires a quartern of this oil to every pound of colour.

The siccative oil is prepared of one half ounce of litharge, as much of calcined ceruse, as much of *terre d'ombre*, a colour with which the French paint shadows, and as much of talc boiled for two hours on a slow and equal fire, with one pound of linseed oil, and stirred the whole time. It must be carefully skimmed and clarified, and the older it grows it is better.

§ 3. *Observations on the Quantities of Substances and Liquids.*

1. Ochres and earths require more liquids both in grinding and diluting than ceruse.

2. Different quantities of liquids are required in the grinding only on account of greater or less dryness; but in diluting, the quantity is always the same.

3. For the first layer after the priming, which has no relation to the colours laid on afterwards, to a square fathom give fourteen ounces of ceruse, about two ounces of liquid to grind, and four ounces to dilute it. If there is a second layer of the same materials, the quantities will require to be less.

4. It will require three pounds of colour for three layers of a square fathom. The first may consume eighteen ounces, the second sixteen, and the third fourteen.

5. To compose these three pounds of colour, take two or two and a half pounds of grinded colours, and dilute them in a pint or three half pints of oil, mixed with essence or pure oil. But if the first layer of ceruse is not used, there will be a necessity for a greater quantity of colours.

N. B. In the following kinds and applications of oil painting, we are to hold those proportions in our eye.

§ 4. *Painting in simple Oil.*

31 Of doors, windows, and window shutters.

On doors and windows give a layer of ceruse grinded in oil of walnuts diluted in the same oil, together with a little siccative; then give another layer of the same preparation; to which, if you want a grayish colour, add a little black of charcoal and Prussian blue, grinded also in oil of walnuts. If to these you incline to add a third layer, grind and dilute it in pure walnut oil; observing that the two last layers be less clear, or have less oil in them, than the first; the colour in this case is more beautiful and less apt to blister with the sun.

32 Of walls.

Walls that are to be painted must be very dry; and this being supposed, give two or three layers of boiling linseed oil to harden the plaster; then lay on two layers of ceruse or ochre, grinded and diluted in linseed oil; and when these are dry, paint the wall.

33 Of tiles.

To paint tiles of a slate colour, grind separately ceruse and German black in linseed oil; mix them together in the proportion which the colour requires, and dilute them in linseed oil: then give the first layer very clean to prime the tiles; and make the three next layers thicker, to give solidity to the work.

To paint arbours and all kinds of garden work, give

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give a layer of white cerufe grinded in oil of walnuts, and diluted in the fame oil, with the addition of a little litharge, then give two layers of green, compofed

34 Of arbours, &c. of one pound of verdigris and two pounds of white lead, grinded and diluted in oil of walnuts. *N. B.* This green is of great fervice in the country for doors, window fhutters, arbours, gardens, feats, rails, either of wood or iron; and in fhort for all works expofed to the injuries of the weather.

35 Of ftatues and vafes. To whiten ftatues, vafes, and all ornaments of ftone, either within or without doors; firft clean the fubject well, then give one or two layers of white cerufe, grinded and diluted in pure oil of pinks, and finifh with giving one or many layers of white lead prepared in the fame manner.

36 Painting on the infide of the houfe. If you wifh to paint on walls not expofed to the air, or on new plafter, give one or two layers of boiling linfeed oil, and continue the brufh till the walls are fully foaked; then give a layer of white cerufe, grinded in oil of walnuts, and diluted with three-fourths of the fame oil and one-fourth effence; and laftly, give two layers more of white cerufe, grinded in oil of walnuts and diluted in oil mixed with effence, if it is not to be varnifhed; but in pure effence if it is. It is in this manner that walls are painted white. If you adopt another colour, it is neceffary to grind and dilute it in the fame quantities of oil and effence.

37 Chairs, benches, ftone, and plafter. To paint chairs, benches, ftone, or plafter, give a layer of white cerufe grinded in oil of walnuts and diluted in the fame oil, into which you have caft a little litharge to make it dry; then apply a layer of the tint you fix on, grinded in oil and diluted in one part oil and three parts effence; and afterwards give two more layers of the fame tint grinded in oil and diluted in pure effence: This may be varnifhed with two layers of fpirit of wine.

38 Steel colour for locks. To make a fteel colour, grind feparately in effence, white cerufe, Pruffian blue, fine lac, and verdigris. The tone which you require is procured by the proper mixture of thofe ingredients. When you have fixed on the tone of colour, take about the fize of a walnut of the ingredients, and dilute them in a fmall veffel in one part of effence and three parts of white oily varnifh. *N. B.* This colour is generally made of white cerufe, of black charcoal, and Pruffian blue, grinded in thick oil, and diluted in effence, which is the cheapeft method of procuring it; but the former is the moft beautiful.

39 Balluftrades and railings. For painting balluftrades and railings, dilute lamp black with varnifh of vermilion; giving two layers of it, and afterwards two layers of fpirit of wine varnifh.

40 Wainfcotting of apartments. Since the difcovery of oil painting, and the knowledge that wood is preferved by it, and efpecially fince the difcovery of a varnifh without fmell, and which even takes away that of oil, the painting of apartments in oil has been with juftice preferred.

In fact the oil ftops up the pores of the wood; and although it does not altogether refift the impreffion of moifture, yet the effect is fo little perceptible, that it is to be recommended as the beft method of preferving wood.

To preferve wainfcotting in the moft effectual manner from moifture, it is neceffary to paint the wall behind it with two or three layers of common red, grinded and diluted in linfeed oil.

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To paint the wainfcotting itfelf, give a layer of white cerufe grinded in oil of walnuts, and diluted in the fame oil mixed with effence. This layer being dry, give two more of the colour you have adopted, grinded in oil and diluted in pure effence. If you wifh the mouldings and fculpture to be painted in a different colour, grind and dilute it in the fame manner.

Two or three days after, when the colours are fully dry, give two or three layers of your white varnifh without fmell, and which alfo prevents the offenfive fmell of the oil colours. *N. B.* Thofe who begin their operations in water colours, if they find it more agreeable, may finifh it in oil colours as above.

When the pores of the wood are well ftopped by the prepared white, a layer of white cerufe grinded in oil of walnuts, and diluted in the fame oil, mixed with effence, may be applied. This will be fufficient, the wood being previoufly primed; and afterwards lay on your intended colour and varnifh.

### § 5. *Painting in Oil with the polifhed Varnifh.*

This is the beft kind of oil painting, owing more to the care it requires than to the proceedings, for they are nearly the fame with thofe of fimple oil painting; the difference confifting only in the preparation and manner of finifhing.

To paint wainfcottings of apartments with the polifhed varnifh, it is neceffary, in the firft place, that the pannels be new. Then, 41 Wainfcottings.

1. Make the furface of the fubject which you mean to paint very fmooth and level, which is done by a layer, which ferves to receive the hard tint or polifhed ground and the colours.

This layer ought to be of white, whatever colour you are afterwards to apply. It confifts of white cerufe, grinded very fine in linfeed oil, with a little litharge, and diluted in the fame oil mixed with effence.

2. Make the polifhed ground by feven or eight layers of the hard tint. In painting equipages, a dozen is neceffary.

The hard tint is made, by grinding pure white cerufe, which has not been much calcined, very finely in thick oil, and diluting it with effence. You muft take care that the layers of the hard tint be not only equal as to the application, but to the quantity of the white cerufe and the oil, and to the degree of calcination. Then,

3. Soften this ground with pumice ftone.

4. Polifh it moderately with a piece of ferge foaked in a pail of water, in which you have put fome powder of pumice ftone finely grinded and paffed through a fine fieve. There is no occafion to fpare wafhing, as this part of the operation will not fpoil with water.

5. Choofe the tint with which you intend to decorate your apartment; grind it in oil, and dilute it in effence; pafs it through a piece of very fine filk, give two or three layers carefully and thinly fpread over the furface, as on this part of the operation depends in a great meafure the beauty of the colour. All forts of colours

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colours may be employed in this manner in oil of essence.

6. Give two or three layers of a spirit of wine varnish, if it is to wainscotting; if to the body of a coach, a varnish of oil is employed. If the varnish is to be polished, it is necessary to give seven or eight layers at least, laid on equally and with great precaution, not to be thicker in one place than another, which occasions spots.

7. It is again polished with pumice stone reduced to powder, and water, and a piece of serge. If the wainscotting has been painted before, it is necessary to rub off the colour till you come to the hard tint, which is done with pumice stone and water, or with a piece of linen dipped in essence.

42 White varnish polish in oil.

There is a white painting in oil, called *white varnish polish*, which corresponds to the king's white in water colours, and is equal to the freshness and gloss of marble if it is applied to wood. To paint in this manner,

1. Give a layer of white ceruse grinded in oil of walnuts, with a little calcined copperas, and diluted in essence. But if it is applied to stone, it is necessary to employ oil of walnuts and calcined copperas alone.

2. Grind white ceruse very fine in essence, and dilute it in fine white oil varnish with copal.

3. Give seven or eight layers of it to the subject.—The varnish mixed with the white ceruse dries so promptly, that three layers of it may be given in a day.

4. Soften and polish all the layers as above.

5. Give two or three layers of white lead grinded in oil of walnuts, and diluted in pure essence.

6. Give seven or eight layers of white spirit of wine varnish, and then polish them.

### § 6. *Of Painting in Varnish.*

To paint in varnish, is to employ colours grinded and diluted in varnish, either in spirits of wine or oil, on all sorts of subjects. Wainscotting, furniture, and equipages, are painted in this manner, though we shall confine ourselves to the first.

1. Give two layers of white of Bougival, diluted in a strong size boiling hot.

2. Give a layer of what the French call *de blanc apprit*.

3. Full up the defects of the wood with mastich in water; and when the layers are dry, smooth them with the pumice stone.

4. When the wood is smooth, suppose the paint a gray colour, take one pound of white ceruse, one drachm of Prussian blue, or of black of charcoal or ivory black; put the white into a piece of leather, so tied that the colours cannot escape; shake them till they are sufficiently mixed.

5. Put two ounces of colours into a quartern of varnish, mix them carefully; give one layer above the white.

6. This layer being dry, put one ounce of colours into the same quantity of varnish as above, and give a second layer.

7. To the third layer give half an ounce of colour to the same quantity of varnish.

8. As each of these layers dry, be careful to rub them with a piece of new coarse cloth, in such a manner, however, as not to injure the colour. *N. B.* The three layers may be given in one day.

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9. If you want to give a perfect lustre, add a fourth layer prepared as the third.

All other colours, as blue, &c. may be applied in the same manner. This method is the only one by which orpiment can be employed in all its beauty, but not without some of its inconveniences.

Another manner of performing this kind of work, is to apply the colours and the varnish without previously using the size and the white ground. This is extremely expeditious, but it is easy to perceive it will want the polish and brilliancy of the other.

## SECTION IV.

We cannot perhaps more properly conclude this article, than with an account of M. de Morveau's attempts to render more perfect the proportion of colours, and especially of *white*, employed in painting. These we shall extract from a memoir of his read in the Academy of Dijon.

"White (says the ingenious academician) is the most important of all colours in painting. It affords to the painter the materials of light, which he distributes in such a manner as to bring his objects together, to give them relief, and that magic which is the glory of his art. For these reasons I shall confine my attention at present to this colour.

43 Examination of known whites.

"The first white which was discovered, and indeed the only one yet known, is extracted from the calx of lead. The danger of the process, and the dreadful distemper with which those employed in it are often seized, have not yet led to the discovery of any other white. Less anxious, indeed, about the danger of the artist than the perfection of the art, they have varied the preparation, to render the colour less liable to change. Hence the different kinds of white, viz. white of crems in Austria, white lead in shells, and white ceruse. But every person conversant in colours, knows that the foundation of all these is the calx of lead, more or less pure, or more or less loaded with gas. That they all participate of this metallic substance, will indeed appear evident from the following experiment, which determines and demonstrates the alterability of colours by the phlogistic vapour.

"I poured into a large glass bottle a quantity of liver of sulphur, on a basis of alkali, fixed or volatile, it makes no difference; I added some drops of distilled vinegar, and I covered the mouth of the bottle with a piece of pasteboard cut to its size, on which I disposed different samples of crems, of white lead, and of ceruse, either in oil or in water; I placed another ring of pasteboard over the first, and tied above all a piece of bladder round the neck of the bottle with a strong packthread. It is evident, that in this operation I took advantage of the means which chemistry offers to produce a great quantity of phlogistic vapour, to accomplish instantaneously the effect of many years; and, in a word, to apply to the colours the very same vapours to which the picture is necessarily exposed, only more accumulated and more concentrated. I say the same vapour, for it is now fully established, that the smoke of candles, animal exhalations of all kinds, alkalescent odours, the electric effluvia, and even light, furnish continually

continually a quantity more or less of matter, not only analagous, but identically the same with the vapour of vitriolic acid mixed with sulphur.

"If it happens that the samples of colours are sensibly altered by the phlogistic vapour, then we may conclude with certainty, that the materials of which the colours are composed, bear a great affinity to that vapour; and since it is not possible to preserve them entirely from it in any situation, that they will be more or less affected with it, according to the time and a variety of circumstances.

"After some minutes continuance in this vapour, I examined the samples of colours submitted to its influence, and found them wholly altered. The ceruse and the white lead both in water and oil were changed into black, and the white of crems into a brownish black; and hence those colours are bad, and ought to be abandoned. They may indeed be defended in some measure by varnish: but this only retards for a time the contact of the phlogistic vapour; for as the varnish loses its humidity, it opens an infinite number of passages to this subtile fluid.

"After having ascertained the instability of the whites in common use, I made several attempts to discover such as would prove more lasting; and though many of these attempts were without effect, I shall give a succinct account of the whole, which may save a great deal of trouble to those who wish to travel over the same field.

"There are three conditions essential to a good colour in painting.

"*First*, That it dilute easily, and take a body both with oils and with mucilages, or at least with the one or other of these substances, a circumstance which depends on a certain degree of affinity. Where this affinity is too strong, a dissolution ensues; the colour is extinguished in the new composition, and the mass becomes more or less transparent; or else the sudden re-action absorbs the fluid, and leaves only a dry substance, which can never again be softened. But if the affinity is too weak, the particles of colour are scarcely suspended in the fluid, and they appear on the canvass like sand, which nothing can fix or unite.

"The *second* condition is, That the materials of which colours are composed do not bear too near an affinity with the phlogistic vapour. The experiments to which I submitted whites from lead, is an infallible means of ascertaining the quality of colours in this respect, without waiting for the slow impression of time.

"A *third* condition equally essential is, That the colouring body be not volatile, that it be not connected with a substance of a weak texture, susceptible of a spontaneous degeneracy. This consideration excludes the greater part of substances which have received their tint from vegetable organization; at least it makes it impossible to incorporate their finer parts with a combination more solid.

"After these reflections, my researches were directed, first, to the five pure earths; next, to the earthy compounds; in the third place, to the earthy salts, which can scarcely be dissolved; lastly, to the metallic earths, either pure or precipitated by Prussian alkali. M. Wenzel has discovered a sixth earth, which I call *eburne*, and which, after other experiments, I thought of applying to the purposes of painting; but I soon perceived that it would have the same fault with other kinds of earth, and, besides, that it could not be obtained but at a very considerable expence.

"The five pure earths possess fixity in a very great degree, and at the same time are little affected by the phlogistic vapour; but they refuse to unite with oil or mucilages, and the white is totally extinguished when they are grinded with these liquids. I made several attempts on earth from alum, not only because M. Beaumé recommended the use of it in painting, and because it enters into the composition of Prussian blue, but also because it is a chief ingredient in ochres, and other earths of that nature, which supposes that it should unite in a certain degree with diluting liquors; notwithstanding, in whatever manner I treated it, it would not yield a white; but one will be less surprised at this want of success, when he considers, that in the ochres and Prussian blue, the earth from alum is only the vehicle of the colouring body, whereas here it is the colour itself.

"To be convinced of the truth of this observation, it is only necessary to mix equal parts of this earth, or even of clay not coloured, with ceruse or any other white: the mixture will be susceptible of being grinded in oil or in gum without being extinguished; it will easily unite with any coloured substance, and be productive of no bad consequences to the pure earths.

Nature and art present to us a considerable number of earthy compositions sufficiently white for the purposes of painting; such as the jasper white, the feldspat white, the schirl white, &c. But all these substances, in all the trials which I made, had the fault which I have already mentioned; and originating from the same cause, they wanted a fixed colouring body, which would not change when it is pulverized, nor be extinguished when it is diluted.

"The ultramarine blue, which is extracted from the blue jasper, and known by the name of lapis lazuli, seems at first view to warrant the possibility of appropriating to painting all the opaque half vitrified compositions of the nature of jasper.

"Prepossessed with this idea, I conceived the hope of producing a true white lapis; but I soon perceived that the experiment confirmed the principle which I had laid down from my observations on pure earths; since it is not the substance peculiar to the jasper which constitutes the ultramarine blue, but the metallic substance which accidentally colours this particular kind of jasper.

"In the same manner, art in this imitation of nature should have for its object to give a permanent base to a colour already formed, to fix it without altering, and to augment perhaps its splendour and its intensity, without attempting to produce a colour.

"In excepting from earthy and metallic salts all those of which the acid is not completely saturated, which would easily attract the humidity of the air, or which would be easily dissolved, you have but a very small number to make experiments on.

"The natural and artificial *selenite* gives with oil a paste without colour, and tasting somewhat like honey; its white is better preserved with a gum, but even in this case it resembles a half transparent pap.

"The natural or regenerated *spat perant* is the most likely salt to produce white. As it is of all others the

most

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most difficult to dissolve, it appears after pulverization to be a very fine white, but is scarcely touched with oil when it becomes gray and half transparent: the mucilage alters it also, although less discernibly; and it does not even resume its white colour after it becomes dry on the canvass.

"The same is the case with *calcareous borax*, formed by the solution of borax in lime water; its white is completely extinguished with oil, less so with gum; but it hardens so instantaneously with the latter, that it is impossible ever to dilute it again.

"Calcareous tartar, obtained by casting quicklime into a boiling solution of cream of tartar, is affected with oil in the same manner as selenite; but with mucilaginous water it gives a pretty good white, only possessed of little reflection, and appearing like plaster; it applied very well to the canvass, and resisted the phlogistic vapour.

"According to M. Weben, in his work entitled *Fabriben and Kunste*, published 1781, the white called in Germany *krembser wiess*, is nothing but the vitriol of lead, prepared by dissolving lead in nitrous acid, and precipitating it in vitriolic acid; and forming it afterwards into solid tablets by means of gum water. It is certain that this resembles in no shape the white called in France the white of crems; at least I never found that it could be dissolved in vinegar; but I tried the white prepared in M. Weben's manner, and the result was the same as above, that is to say, it turned completely black.

"The vitriols of lead and of bismuth alter more speedily than the calces of those metals. And thus, with the exception of calcareous tartar, which may be of some use in water colours, the best earthy salts on which I have made experiments, may all, or the most of them, give a base to some colours, but cannot constitute by themselves a colour useful in painting.

"Of the fifteen known metallic substances, there are nine which yield white calces: namely, silver, mercury, lead, tin, antimony, bismuth, zinc, arsenic, and manganese.

"Of these nine substances, we may almost pass over silver and mercury; because, though they yield a very fine white, precipitated by means of crystallized vegetable alkali, yet it is soon altered when exposed to the air; that from silver changing into black, and that from mercury into yellow.

"It is well known that lead gives a very good white, and one which unites easily with oil or size; but that it is extremely liable to change, has been my principal object to prove; and the experiments which I have made place it beyond contradiction.

"I shall only add, that if there is a preparation able to correct this fault, it should be the precipitation of the earth of this metal in its acetous dissolution by Prussian alkali; but the white which results from this preparation becomes sensibly brownish when it is exposed a few minutes only to the phlogistic vapour.

"It would be therefore unreasonable to persevere in the use of this substance, or to wish to render it fixed, since the changes which it undergoes do not alter its nature, and the indestructible order of its affinities.—The calx of tin is easily applied to any purpose, and experiences no change from the concentrated phlogistic vapour. These considerations induced me to endeavour to obtain this calx perfectly white; and here follows the result of my operations: The tin of calcined *melac* gives a pretty white calx; but whatever attention I paid to take off the red surface which the violence of the fire occasioned, it takes always a shade of gray when it is diluted. Tin calcined by nitre in fusion, gives a tarnished and gross calx, which multiplied washings could not deprive of a yellowish tint.

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"Having precipitated, by means of crystallized vegetable alkali, a solution of English tin, which had been made in the muriatic acid, after the manner of M. Bayen to extract the arsenic, I had a calx of the greatest whiteness, so light that it buoyed up to the surface of the liquor, and so thin that the greater part of it passed through the filter; but it experience at the same time a kind of adherence with the salts, which makes the part of it retained by the filter incapable of being pulverized, gummy, half transparent, and even a little changed into yellow. In this condition it is extinguished when diluted; it is necessary, therefore, to moisten it in boiling water, and afterwards to calcine slightly the sediment after it has had sufficient time to settle.

"I have tried the calcination by means of moisture, in employing the tin of the purest melac, and a rectified nitrous acid, according to the method of Meyer. It formed a very white sparkling calx, which remained in the filter in the consistency of jelly.—Meanwhile, I observed that it was always a little yellow by the mixture of a portion of that earth which took, in the operation, the colour of turbith mineral.

"A very fine white calx is extracted from antimony, calcined by nitre in fusion; but the earth of this semimetal must be placed in the number of those which combine too easily with the phlogistic vapour. The diaphoretic antimony, grinded in oil, took in ten minutes in my phlogistic apparatus a colour somewhat like sulphur.

"The property of bismuth to give a very fine white calx, known by the name of *magistery*, or white fard, is generally known; it is easily prepared, since it is only necessary to dissolve the bismuth in nitrous acid, and to precipitate the solution by pure water: it dilutes perfectly with oil and mucilages. But this colour ought to be rejected, as the most alterable by the phlogistic vapour. It became completely black in ten minutes in my apparatus; and this fact is also proved from what happens to women who use this colour, when they are exposed to the vapours of sulphur, of garlic, or of any putrid substances.

"Zinc furnishes by all the processes of calcination and precipitation a pretty white calx, when it is pure and separated from iron; otherwise the solutions of the vitriol of zinc will become yellow when exposed to the air. I have precipitated those solutions by lime water, by caustic, and effervescent alkalis; I have calcined this semi-metal alone and with nitre; and in also those operations I have obtained an earthy substance of different degrees of whiteness, which, after it was dried and prepared, mixed readily with oil and mucilages

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mucilages without losing its colour; and which experienced no sensible change when exposed to the phlogistic vapour.

"These valuable properties, the chief object of my researches, engaged me to multiply my experiments, to determine at once the most economical process, and the most advantageous and infallible preparation.—These attempts have convinced me, that the calcination of this semi-metal alone in a crucible, placed horizontally on the corners of a reverberating furnace, gives the purest, the whitest, and the least reducible calx; and that to make an excellent colour, it is sufficient to separate the parts not burned with water, and grind it with a little of the earth of alum or chalk to give it a body. Zinc precipitated in Prussian alkali, even in distilled vinegar, retains always a shade of yellow, does not unite so well in oil, and takes a demi-transparent consistence like cheese.

"White arsenic extinguishes much less in diluting than one would believe from its saline nature; it preserves its colour best in gum water; and it is remarkable, that instead of turning black in the phlogistic vapour, it takes a very distinct shade of yellow. This property is sufficiently singular and constant to furnish a new method of analyzing arsenic, so as to know it. And this alteration of colour makes it of no use in painting, although its deleterious qualities did not forbid the practice.

"The semi-metal known by the name of *manganese* gives also a white calx. I had at first great hopes from this colour, as, contrary to all those extracted from the other metals, it became white by the phlogistic vapour. There remained, therefore, but one difficulty to overcome, viz. to separate from the manganese the portion of iron which it usually contained, and which infallibly makes the earth a little yellow. To accomplish this in the cheapest manner, I submitted the black ore of the manganese to a long calcination, to render its iron insoluble; I afterwards applied vinegar to it, after the example of M. de la Peyrouse; and in precipitating the dissolution by effervescent alkali, I easily obtained a pure white precipitate. But I soon perceived that the facility with which a colouring body loses its phlogiston, is no less an inconveniency than that of attracting it, and productive of the same alterations.

"The white of manganese became very soon yellow when exposed to the air: and this is not to be ascribed to the iron contained in it, since neither the galls nor Prussian alkali had discovered any of it in the dissolution. This substance, therefore, can be of no use in producing a white colour for painting."

The experiment by which M. de Morveau tried the colours not alterable by the phlogistic vapour, was performed before the academy, the prince of Condé being president. "I placed (says he) in my apparatus pieces of cloth, on which were laid the white of calcareous tartar in water, different preparations of white from tin and zinc, in oil and water; and I allowed them to continue exposed to the phlogistic vapour during a sitting of the academy: if they were not altered, their superiority over the whites in use would be sufficiently established. The sitting continued for near an hour; and the bottle having been opened, all the colours continued to have the same shade which they had before. I can, therefore, recommend to painters those three whites, and particularly that of zinc, the preparation of which is exposed to less variation, the shade more lively and uniform, and moreover it is fit for all purposes, and perhaps procured at less expence.

"I will assert farther, that it may be procured in sufficient quantities to supply the place of ceruse in every branch of the art, even in interior house painting:—I would recommend it, less with the view of adding new splendour to this kind of ornament, than for the safety of those who are employed in it, and perhaps for the safety of those who inhabit houses ornamented in this manner.

"But without being too sanguine, although the processes in the fabrication be simplified in proportion to the demand, as is usually the case, yet there is reason to apprehend, that the low price of ceruse will always give it the preference in house painting. With regard to those who apply colours to nobler purposes, they will not hesitate to employ the white of zinc. I am assured that four franks is paid for the pound of white of crems; and I believe the white in question, prepared in the manner which I have poined out, might be sold for six.

"M. Courtors, connected with the laboratory of the academy, has already declared that it is used for house painting: less, however, in regard to its unalterability, than to its solubility: and this can be the more readily believed, as the flower of zinc enters into many compositions of the apothecary. The same M. Courtors has arrived at the art of giving more body to this white, which the painters seemed to desire, and also of making it bear a comparison with white lead either in water or oil. The only fault found with it, is its drying slowly when used in oil; but some experiments which I have made, incline me to believe that this fault may be easily remedied, or at least greatly corrected, by giving it more body. At any rate, it may be rendered siccative at pleasure, by adding a little vitriol of zinc or copperas slightly calcined.

"Painters already know the properties of this salt, but perhaps they do not know that it mixes with the white of zinc better than with any other colour; the reason is, they have chemically the same base. It is prepared by purging the white copperas of that small portion of iron which would render it yellow; and this is easily done in digesting its solution, even when cold, on the filings of zinc.

"The mixture of this salt thus prepared is made on the pallet, without producing any alteration, and a small quantity will produce a great effect."

Pair, Pairing.

PAIR; two of a sort, a couple.

PAIRING, the uniting or joining in couples.

The instinct of pairing is bestowed on every species of animals to which it is necessary for rearing their young; and on no other species. All wild birds pair; but with a remarkable difference between such as place their nests on trees and such as place them on the ground. The young of the former, being hatched blind, and without feathers, require the nursing care of both parents till they be able to fly. The male feeds his mate on the nest, and cheers her with a song. As soon as the young are hatched, singing yields to a more necessary occupation, that of providing food for a numerous issue; a task that requires both parents.

Eagles and other birds of prey build on trees, or on other inaccessible spots. They not only pair, but continue in pairs all the year round; and the same pair procreates year after year. This at least is the case of eagles: the male and female hunt together, unless during incubation, at which time the female is fed by the male. A greater number than a single pair are never seen in company.

Gregarious birds pair, in order probably to prevent discord in a society confined to a narrow space. This is the case particularly of pigeons and rooks. The male and female sit on the eggs alternately, and divide the care of feeding their young.

Kames's Sketches, Vol. I. p. 198.

Partridges, plovers, pheasants, sea fowl, grouse, and other kinds that place their nests on the ground, have the instinct of pairing; but differ from such as build on trees in the following particular, that after the female is impregnated, she completes her task without needing any help from the male. Retiring from him, she chooses a safe spot for her nest, where she can find plenty of worms and grass seed at hand; and her young, as soon as hatched, take foot, and seek food for themselves. The only remaining duty incumbent on the dam is, to lead them to proper places for food, and to call them together when danger impends. Some males, provoked at the desertion of their mates, break the eggs if they stumble on them. Eider ducks pair like other birds that place their nests on the ground; and the female finishes her nest with down plucked from her own breast. If the nest be destroyed for the down, which is remarkably warm and elastic, she makes another nest as before. If she is robbed a second time, she makes a third nest; but the male furnishes the down. A lady of spirit observed, that the eider duck may give a lesson to many a married woman, who is more disposed to pluck her husband than herself. The black game never pair: in spring, the cock on an eminence crows, and claps his wings; and all the females ithin hearing instantly resort to him.

Pairing birds, excepting those of prey, flock together in February, in order to choose their mates. They soon disperse; and are not seen afterward but in pairs.

Pairing is unknown to quadrupeds that feed on grass. To such it would be useless; as the female gives suck to her young while she herself is feeding. If M. Buffon deserves credit, the roe deer are an exception. They pair, though they feed on grass, and have but one litter in a year.

Beasts of prey, such as lions, tygers, wolves, pair not. The female is left to shift for herself and for her young; which is a laborious task, and often so unsuccessful as to shorten the life of many of them. Pairing is essential to birds of prey, because incubation leaves the female no sufficient time to hunt for food. Pairing is not necessary to beasts of prey, because their young can bear a long fast. Add another reason, that they would multiply so fast by pairing, as to prove troublesome neighbours to the human race.

Pairing, Paisley.

Among animals that pair not, males fight desperately about a female. Such a battle among horned cattle is finely described by Lucretius. Nor is it unusual for seven or eight lions to wage bloody war for a single female.

The same reason that makes pairing necessary for gregarious birds, obtains with respect to gregarious quadrupeds; those especially who store up food for winter, and during that season live in common. Discord among such would be attended with worse consequences than even among lions and bulls, who are not confined to one place. The beavers, with respect to pairing, resemble birds that place their nests on the ground. As soon as the young are produced, the males abandon their stock of food to their mates, and live at large; but return frequently to visit them while they are suckling their young.

Hedgehogs pair, as well as several of the monkey kind. We are not well acquainted with the natural history of these animals; but it would appear that the young require the nursing care of both parents.

Seals have a singular economy. Polygamy seems to be a law of nature among them, as a male associates with several females. The sea turtle has no occasion to pair, as the female concludes her task by laying her eggs in the sand. The young are hatched by the sun, and immediately crawl to the sea.

PAISLEY, a town of Renfrewshire, in Scotland, situated about six miles and a half west of Glasgow, on the river White Cart, over which there are two stone bridges of two arches each, and one which consists of three arches. The town is very ancient; but was of much less consequence formerly than it is at present. "No satisfactory etymology has hitherto occurred of the name *Paisley*. The following has been suggested by a good Gaelic scholar: 'A ridge of rocks that runs across the river, and forms a beautiful cascade, would, prior to the building of the town, be undoubtedly the most striking object that this place would present. The brow or face of a rock is in Gaelic *Pais-licht*. A church in front of the rock would be the church in *Pais-licht*. A church did stand here previous to 1160: it is named in the foundation charter *Ecclesia de Paselet*, Latinized, in the records of the monastery, *Paslatum*, an easy derivative from *Pais-licht* in all probability the original of the modern *Paisley*.' It was erected into a burgh of barony by James IV. in the year 1488, at that time probably deriving all its importance from the rich monastery which had been established there for several ages; for George Schaw, who was then abbot of that monastery which had been privileged from the king. Even in Mr Crawford's time wrote the history of the shire of Renfrew near the beginning of this century, it seems to have been but an inconsiderable place; for he describes it as consisting only of one principal street, about half a mile in length, with several lanes belonging to it; whereas now

Statistical Account of Scotland, Vol. VII.

Paisley. now the town, with its suburbs, occupies such an extent of ground, that strangers are apt to consider it as, next to Edinburgh and Glasgow, the largest and most populous town in Scotland. Its buildings of late years have been greatly improved; its streets are well paved; and the different parts of the town and suburbs, where the river intervenes, are connected with one another by three bridges at convenient distances."

The affairs of the community are managed by three bailies, of which the eldest is commonly in the commission of the peace, a treasurer, a town clerk, and 17 counsellors, who are annually elected upon the first Monday after Michaelmas. It enjoys all the powers necessary for government and police, without any of the burdens to which royal boroughs are subjected. The freedom of the place is conferred on very moderate terms. The revenues of the town are not great, but they have been managed to the best advantage. The rapid increase of the place has not been attended with a proportional increase of revenue; therefore several necessary improvements, and intended public buildings, are not yet carried into execution. It gives the title of baron to the earls of Abercorn; the first of whom was a younger son of the Duc de Chatelherault. The *black book of Paisley*, frequently mentioned in Scottish history, was a chronicle of the public affairs and remarkable events, kept by the monks who resided in the monastery. It agreed in every material fact with the *Scoti-chronicon* of Fordun; and is by many thought to be the same performance.

The old part of the town runs from east to west upon the south slope of a ridge of hills, from which there is a fine prospect of the city of Glasgow and the adjacent country; but to the southward, the view terminates in a ridge of green hills, about two miles distant. Including the late buildings and suburbs, it is fully a mile long, and nearly as much in breadth. On the east side of the river Cart, stand the abbey and new town. This new town was some years ago feued off by the earl of Abercorn, and now consists of a number of handsome buildings. The streets are laid off in a regular manner, but (rather unfortunately for the conveniency and elegance of some of the houses) not in right angles. Here the earl of Abercorn has built at his own expence one of the largest, most commodious, and most elegant inns in Scotland. In the vicinity of this his lordship is likewise to build several convenient and necessary market places. A little way south of the inn stands the abbey church, the only one which Paisley formerly required. This church, when entire, has been a most noble building, and consisted of several distinct and separate places of worship: what now remains of this magnificent Gothic structure is not yet unworthy the notice of the curious in antiquities. Mr Pennant says, the great north window is a noble ruin, the arch very lofty, the middle pillar wonderfully light, and still entire: only the chancel now remains, which is divided into a middle and two side aisles, by very lofty pillars, with Gothic arches; above these is another range of pillars much larger, being the segment of a circle, and above a row of arched niches from end to end, over which the roof ends in a sharp point. The outside of the building is decorated with a profusion of ornaments, especially the great west and north doors, than which scarce any thing lighter or richer can be imagined. Paisley.

The town of Paisley continued a part of the original or Abbey parish of Paisley till the year 1738; when the magistrates and council having purchased the right of patronage from the then earl of Dundonald, a new church was built, and the town was erected into a separate parish. This is called the *Laigh Church*, is built in the form of a Greek cross, very well laid out, and capable of containing a great number of people. In 1756 another church was built, upon a very extended plan, to accommodate its multiplied inhabitants; in which, though it is one of the largest in Scotland, yet the most distant of the congregation can hear a tolerably good speaker with ease and distinctness; and as it stands upon the highest part of the town, it was afterwards ornamented with a lofty and well-proportioned spire visible at a great distance. This is called the *High Church*, and is a very fine building: it is an oblong square of 82 feet by 62 within the walls, built of free stone well smoothed, having rustic corners and an elegant stone cornice at the top. In the construction of the roof (which is a pavilion covered with slate, having a platform covered with lead on the top), there is something very curious, and it is admired by every person of taste. In 1781, the number of the inhabitants still rapidly increasing, another church, called the *Middle Church*, was built, not quite so large as the former, but very handsomely and elegantly finished: and in the following year, the town was divided and erected into three separate parishes, exclusive of the Abbey parish, and named according to their respective churches.

There are two large dissenting congregations in the town; those of the Antiburgher persuasion and the Relief. The first of these has existed there for upwards of 50 years; the other is of a late date. There is besides a small congregation of Cameronians.

The townhouse is a very handsome building of cut stone, with a tall spire and a clock. The flesh market has a genteel front of cut stone, and is one of the neatest and most commodious of the kind in Britain. Butchers meat, butter, cheese, fish, wool, and several other articles, are sold here by what they call the tron pound, of 22 English ounces and a half.

The poors house is a large building, very well laid out; and stands opposite to the quay, in a fine free air. It is supported by a small tax laid upon the inhabitants quarterly.

Close by the Abbey church is the earl of Abercorn's burial place, the greatest curiosity in Paisley. It is a vaulted Gothic chapel, without pulpit, pew, or any other ornament, but has the finest *echo* perhaps in the world. When the end door (the only one it has) is shut, the noise is equal to a loud and not very distant clap of thunder. If you strike a single note of music, you have the sound gradually ascending, with a great number of repetitions, till it dies away as if at an immense distance, and all the while diffusing itself thro' the circumambient air. If a good voice sings, or a musical instrument is well played upon, the effect is inexpressibly agreeable. The *deepest*, as well as the most *acute tones*, are distinctly reverberated, and these in regular intervals of time. When a musical instrument is

is founded, it has the effect of a number of instruments of a like size and kind playing in concert. When a number of different instruments in unison sounds the same note, a good ear is able to distinguish the variety of sound produced by each. A single instrument sounding a particular note, and then instantly its fifth, or any other concordant note, the two sounds can be heard, as it were, running into and uniting with each other in a manner peculiarly agreeable. But the effect of a variety of instruments playing in concert is particularly charming, and must excite such emotions in the soul as it is impossible to describe. In this chapel is the monument of Marjory Bruce (A); she was daughter of Robert Bruce, and wife of Walter, great steward of Scotland, and mother of Robert II. In this same chapel were interred Elizabeth Muir and Euphemia Ross, both consorts to Robert II.

A particular account of the abbey of Paisley would fill many pages. It was founded as a priory for monks of the order of Clugni about the year 1160 by Walter great steward of Scotland. It was afterwards raised to the rank of an abbacy; and the lands belonging to it were by Robert II. erected into a regality, under the jurisdiction of the abbot. After the Reformation, the abbacy was secularized by the Pope in favour of Lord Claud Hamilton, third son of the duke of Chatelherault, in reward of his steady adherence to the cause of Queen Mary; and, in 1588, it was by the king and parliament erected into a temporal lordship, and Lord Claud was created Lord Paisley. The revenues of the abbacy were very considerable: They consisted of the tythes of 28 different parishes, with the property of the lordships of Paisley, of Kilpatrick in Dumbartonshire, and of Monkton in Ayrshire, extending each to a hundred merk land; and the forty pound land of Glen in Lochwinnoch; with the lands of Achengown, Grange, &c. and a considerable detached property in different parts of the kingdom. All this property, with the patronage of the several churches, fell to Lord Claud Hamilton, last abbot of Paisley. It continued in that family till 1653, when his grandson James earl of Abercorn sold the lordship of Paisley to the earl of Angus, who next year sold it to William Lord Cochran, Kilpatrick to Sir John Hamiltoun of Orbistoun, Monktoun to Lord Bargenny, and Glen to Lord Semple and others. Great part of the lordship of Paisley was at different times sold off by the family of Dundonald; and what remained of it was in 1764 repurchased by the late earl of Abercorn. The fabric of the abbey owed much of its magnificence to Abbot George Schaw, who about 1484 enlarged and beautified the building, surrounding the church, the precincts of the convent, the gardens, and a small deer park with a noble wall of hewn free stone. The abbey was after the Reformation successively the seat of the earls of Abercorn and Dundonald. The late earl of Dundonald demolished the ancient gateway; and, by feuing off the immediately adjoining grounds for building, entirely changed the appearance of the place. As it was thus rendered totally unfit for a family residence, it has since that time been let out into separate dwellings, and is now in a very mean and almost ruinous state. The wall stood almost entire till 1781, when the garden being feued off for building upon by the late earl of Abercorn, the wall was sold to the feuers, and the stones of it employed in their houses.

The vestiges of the Roman camp and *pretorium*, at the west end of the town, are at present almost annihilated. It was supposed to be vaulted underneath.

The number of inhabitants in the town of Paisley amounted in 1695 to 2200; in 1755 they were 4290; in 1782, 11,100; and in 1792 they were 13,800. At present the number of inhabitants in the town and suburbs certainly exceeds 20,000.

Paisley is now the first manufacturing town in Scotland, and is greatly celebrated on account of some of its branches. The manufactory of silk gauze, in this respect, first claims our notice. This branch is brought here to the utmost perfection, and is wrought to an amazing variety of patterns. It has been computed, that there have been no less than 5000 weavers employed in Paisley and in the country adjacent; and the number of winders, warpers, clippers, and others necessary in other parts of the silk manufacture, has been likewise computed to be no less than 5000. Each loom will produce in an average value 70l. yearly; the whole will then be 350,000l.

It appears, from the best calculation that could be made, that in the year 1784 the manufactures of Paisley in silk gauze, lawn and linen gauze, and white sewing thread (B), amounted to the value of 579,185l. 16s. 6d. and that no fewer than 26,484 persons were employed in carrying them on. It is difficult to give an exact account of the state of its manufactures at present. The silk branch has evidently declined, but the muslin has so far come in its room, and the thread manufacture has considerably increased. There is, however, reason to conclude, that, though it is daily advancing, it has not yet recovered its former greatness. Besides these principal manufactures, there are some others carried on there of too much importance to be overlooked: for instance, considerable tan works, four in number, two soap and candle works, a manufacture of ribbons, and another

(A) Her story is singular: In the year 1317, when she was big with child, she broke her neck in hunting near this place: the Cæsarean operation was instantly performed, and the child taken out alive; but the operator chancing to hurt one eye with his instrument, occasioned the blemish that gave him afterwards the epithet of *Blear-eye;* and the monument is also styled that of *Queen Bleary*. Elizabeth Muir died before the accession of her husband Robert.

(B) This was introduced into this town about 60 or 70 years ago. A gentleman in this place lately discovered the method of making what is called *glazed white thread*, to as great perfection as that made by Mr Leland and Son, London. The value of this branch is computed at about 60,000l. annually.

Paisley. another of inkle or tape. In 1789 the annual value of all the manufactures in Paisley of every sort amounted to 660,385l. 16s.

In the various weaving branches there were employed at Whitsunday 1791, in the suburbs of Paisley, 1108 looms, which, added to 2494 employed in the town, gives 3602 in all. But it is to be observed, that the extent to which the weaving branches are carried on by the manufacturers in Paisley, is not to be judged of from the number of looms in the town and suburbs. Besides about 150 in the country part of the parish, there are great numbers employed by them in the villages of Nielstoun, Barhead, Beith, Dalry, Kilwinning, &c. &c. In 1744, when all the business was confined to the town and suburbs, there were 867 looms at work.—The thread-making in Abbey parish employs 9 mills, which, added to 128 employed in Paisley, makes 137 in all. The number in 1744 was 93. The spinning of cotton was introduced into Abbey parish in 1783. The principal seat of that manufactory is at Johnstoun, a neat and regularly built village about three miles west from Paisley, upon the estate of Mr Houston of Johnstoun. The feuing of that village was begun in 1782; and it contained, at Whitsunday 1792, 293 familes, or 1434 souls. There are five companies established in it for cotton spinning. Two of these carry on their principal operations by water machinery. In the two mills employed in them, there are going at present 11,672 spindles; but, when the whole machinery in both shall be completed, there will be 22,572. The number of persons, young and old, at present employed in both mills is 660. There is also in the neighbourhood of Paisley a calico printing work and a copperas work.

The bleaching business in the Abbey parish is carried on to a very considerable extent. There are 10 fields for whitening muslins and lawns, and about as many for thread, almost wholly employed by the manufacturers in Paisley. About 300 persons are at work in this branch of business, of whom about 240 are women, who are hired for the season. A soap and candle manufacture pays about 2000l. of duty *per annum* to government, and has in some years paid upwards of 3000l. A black and hard soap manufacture, 4500l. *per annum*. The starch manufacture is but lately established. The distillery business is to be mentioned under this head: it has for some time past been carried on to a great extent, and the spirit manufactured in great perfection. A considerable quantity of it is exported, but too much of it is consumed at home.

The river on which Paisley stands runs from south to north; and falls into the Clyde, after it has joined the conflux of the rivers Grief and Black Cart at Inchinnan bridge, about three miles below the town. At spring tides, vessels of 40 tons burden come up to the quay. The communication by water is of great importance to the inhabitants: for in this way they are frequently served with fish of different kinds, and can send their goods and manufactures to Port Glasgow and Greenock, and to Glasgow likewise; and now, by means of the great canal, they have also a communication with the frith of Forth.

The air here is moist; a necessary consequence of the prevailing south-west winds, which, coming loaded with vapour from the Atlantic, produce frequent and heavy rains. The effects of this moist atmosphere appear in rheumatisms, quinseys, pneumatic ailments, and all the tribe of inflammatory disorders. Upon the whole, however, neither the town nor country adjacent can be said to be unhealthy. Contagions, indeed, at times visit this as other places, which run their usual course as epidemics; but none are remembered of any uncommon violence except a pleurisy in summer 1771, and which, contrary to the received opinion, was truly epidemic. There are no disorders that can be said to be endemic, unless scrofula is to be excepted, which is still but too common. This has been ascribed to the water used by the inhabitants of Paisley: It more probably proceeded from, and certainly was greatly aggravated by, poor living, and by the damp shops which were necessary for the linen manufacture; for since silk weaving became the general employment, and increase of trade has introduced better living, this disorder is less frequent. From the same causes probably it is that swelled and sore legs, once extremely common here, are now but rarely met with. Dysentery raged with great violence in 1765; since that time it has been scarcely complained of. Nervous fevers at times appear; but they are neither very general nor uncommonly fatal. It is to be apprehended, that the confinement and sedentary posture of the weaver, and the laborious life of the bleacher, are frequent causes of consumptive complaints. Intermittents, which, from the damp air, and adjoining moss, might be expected to be common, are not so much as known. W. Long. 4. 20. N. Lat. 55. 52.

Paisley

Palace

PAIX, a town of America, in the island of Hispaniola, and on the north coast. It was built by the French, to whom it is subject, and has a pretty good harbour. W. Long. 72. 55. N. Lat. 19. 58.

PAITA, a sea port of America, in Peru, and in the audience of Quito. The town consists of about 200 houses but one story high; and the walls are made of split cane and mud, and the roofs only a covering of leaves. The only defence of Paita is a fort without either ditch or out-work; but it is surrounded by a brick wall of little or no strength, on which are mounted eight pieces of cannon. It has frequently been plundered by the bucaniers; and Commodore Anson got possession of its fort in 1741, and took and burnt the town because the governor refused to ransom it. W. Long. 81. 19. S. Lat. 6. 12.

PALACE, PALATIUM, a name generally given to the dwelling houses of kings, princes, and other great personages; and taking different epithets, according to the quality of the inhabitants, as *imperial* palace, *royal* palace, *pontifical* palace, *cardinal* palace, *ducal* palace, *episcopal* palace, &c.

It is customary in China to build palaces in honour of great ancestors. Hu-pi-lay, of the Mogul empire, in the year 1263, built one for his ancestors; and he is the first who borrowed this Chinese custom. Amongst the works of the ancient Egyptians, we have an account, in the Ancient Universal History, of a most magnificent palace in the Upper Egypt, not far from Aswan, the ancient Syrene; the ruins whereof are enough to strike a spectator with astonishment. It is as large as a little city, having four avenues of columns, leading to as many porticoes. At each gate, between two pillars of porphyry, stand two gigantic figures of fine

black

Palace || Palæpaphos.

black marble, armed with maces. The avenues consist of columns set three and three together, in a triangle, on one pedestal: on the chapiter of each triangle is placed a sphinx and a tomb alternately. Every column is 70 feet high, all of one stone. There are in all the four avenues about 5000 or 6000 of these columns, a great many of which are fallen down.

The first hall of this palace is adorned with pieces of history, which seem as fresh as if the painting had not been long finished. In some places they have represented the hunting of antelopes; in others, feasts, and a great many young children playing with all kinds of animals. From thence you go into other apartments, incrusted with marble, the roof being supported with pillars of porphyry and black marble. Notwithstanding the vast quantity of rubbish, our author made shift to get up to the top of this building, from whence he had a prospect of the ruins of the greatest city that ever had been, as he thought, in the world. He supposes it might be the ancient Thebes; but that city stood much lower. *Lucas, Vol. III.*

*Palace-Court.* See Marshalsea.

PALÆMON, or Melicerta. See Melicerta.

Palæmon (Q. Rhemmius), a famous grammarian of Rome, in the reign of Tiberius. He was born of a slave at Vienza. We are told he was first brought up in the business of a weaver: but attending his master's son to school, he used this opportunity to procure knowledge; and acquired so much skill in the common learning, that he obtained his freedom, and became a teacher or preceptor at Rome. His claim to learning cannot be questioned, since he is recorded as a scholar even by Juvenal:

> *Quis gremio Enceladi doctique Palæmonis affert,*
> *Quantum grammaticus meruit labor?* Sat. 7.

He had also an excellent memory, a ready elocution, and could make verses extempore. On account of these qualities, notwithstanding his debauched course of life, which was such that nobody was more unworthy to have the preceptorship of youth, he held the first rank among those of his profession. But his arrogance surpassed his merit: he had the confidence to assert, that learning was born when he was born, and would die when he died; and that Virgil had inserted his name in his Eclogues by a certain prophetic spirit: for that he, Palæmon, would infallibly become one day sole judge and arbiter of all poetry. He was excessively prodigal for the gratification of his voluptuous humour; insomuch that neither the immense sums he gained by teaching, nor the great profit he made both by cultivating his lands and in the way of traffic, proved a sufficient fund to support his extravagancies. We have only some fragments of his works.

PALÆOLOGUS (Michael), a very able man who was governor of Asia under the emperor Theodorus Lascaris; and who, by various stratagems and cruelties, procured the empire for himself and his posterity. See Constantinople, from N° 145 to the end of that article.

PALÆPAPHOS (Strabo, Virgil, Pliny), a town of Cyprus, where stood a temple of Venus; and an adjoining town called *Neo Paphos;* where St Paul struck Elymas blind, and converted the proconsul Sergius Paulus.

2

PALÆSTRA, in Grecian antiquity, a public building where the youth exercised themselves in wrestling, running, playing at quoits, &c. To prevent the combatants from hurting themselves by falling, the bottom of the palæstra was covered with dust or gravel. Some will have the palæstra to be only a part of the gymnasium. Many authors imagine that the palæstra was of two kinds; the one for the exercise of the body, the other for the cultivation of the mind; but the derivation of the word seems to confine it to bodily exercise. Palæstra.

We have this account of the palæstræ in Barthelemi's Anacharsis†: "They are nearly of the same form with the gymnasia. We visited the apartments appropriated to all the species of baths; those where the wrestlers leave their clothes, where they rub their bodies with oil to render their limbs supple, and where they roll themselves in the sand in order to give their antagonists a hold. † Vol. II.

"Wrestling, leaping, tennis, and all the exercises of the lyceum, were here repeated before us with greater varieties, and with more strength and skill on the part of the performers. Among the different groups before us, we distinguished men of the most perfect beauty, and worthy of serving as models for artists: some with vigorous and boldly marked outlines, as Hercules is represented; and others of a more slim and elegant shape, as Achilles is described. The former, devoting themselves to wrestling and boxing, had no object but to increase their bodily strength; the latter, educated to less violent exercises, such as running, leaping, &c. confined themselves to acquirement of agility.

"Their regimen is suited to the different exercises for which they are designed. Some of them abstain from women and wine; others lead a very abstemious life; but those who make laborious exertions stand in need of a great quantity of substantial food, such as roasted beef and pork, to restore their strength. If they require only two minæ a-day, with bread in proportion, they give a very favourable idea of their temperance. But several are mentioned who have made a terrible consumption of provisions. Theagenes of Thasos, for instance, is said to have eaten a whole ox in a day. The same exploit is attributed to Milo of Crotona, whose usual quantity of food for a day was twenty minæ of meat, as many of bread, and three congii of wine. It is said likewise, that Astydamas of Miletus, when at the table of Ariobarzanes the Persian satrap, devoured alone the supper prepared for nine guests. These stories, no doubt exaggerated, prove at least the idea generally entertained of the voracity of this class of wrestlers. When they are able to gratify it without danger, they acquire extraordinary strength: their stature becomes sometimes gigantic; and their adversaries, struck with terror, either decline entering the lists, or sink under the weight of their enormous bodies.

"They are so oppressed by excess of nutriment as to be obliged to pass part of their lives in a profound sleep, and soon become so extremely corpulent as to be no longer known to be the same persons: this is succeeded by disorders which render them as wretched as they have always been unserviceable to their country; for it cannot be denied that wrestling, boxing, and

Palæstrophylax || Palamedea.

and all those combats disputed with so much fury and obstinacy in the public solemnities, are no longer any thing but ostentatious exhibitions, since tactics have been brought to perfection. Egypt at no time adopted them, as they give only a temporary strength. Lacedæmon has corrected their inconveniences by the wisdom of her institutions. In the other states of Greece men have discovered, that, by subjecting their children to them, they incur the risk of injuring their shape and preventing their growth; and that, in a more advanced age, professed wrestlers never make good soldiers, because they are unable to support hunger, thirst, watching, the smallest wants, or the most trifling deviation from their usual habits." See PENTATHLUM and PANCRATIUM.

PALÆSTROPHYLAX, was the director of the palæstra, and the exercises performed there.

PALAMBOANG, or PALAMBANG, a town of Asia, in the East Indies, and in the island of Java, capital of a kingdom; seated at the east end of the island, on the straits of Bally, and separated from the island of Bally by a narrow channel. E. Long. 115. 10. S. Lat. 7. 10.

PALAMEDEA, in ornithology, a genus belonging to the order of grallæ. The character of this genus, according to Latham, is, the bill bends down at the point, with a horn, or with a tuft of feathers erect near the base of it; the nostrils are oval; the toes are divided almost to their origin, with a small membrane between the bottoms of each.

Plate CCCLXXIV.

There are two species of it; the first of which is the palamedea cornuta, or horned screamer. It is about the size of a turkey; in length about three feet four inches. The bill is two inches and a quarter long, and black; the upper mandible is a little gibbous at the base, the under shuts beneath it, as in the gallinaceous tribe: the nostrils are oval and pervious, and placed near the middle of the bill. From the crown of the head springs a slender horn of more than three inches in length, and pointed at the end: the irides are the colour of gold: the plumage on the head, neck, and upper part of the body, is black, margined with gray on the first, and downy: some of the feathers round the neck are likewise edged with the same: the under parts of the wings are pale rufous, appearing on the shoulders and edges of them when closed: at the bend of the wing are two strong, sharp, horny, yellow spurs, one above another, the uppermost an inch and a half in length: the belly, thighs, and vent, are white: the tail is eight inches and a half long, and black: the legs are stout and dusky: the fore claws are moderately bent; the hind one is nearly straight, not unlike that of a lark, and is about an inch long.—The female, we are told, is very like the male.

*Latham's General Synopsis of Birds.*

It is remarked, that they are always met with in pairs; and if one dies, the other mourns to death for the loss. They frequent places near the water; make a large nest of mud, in the shape of an oven, upon the ground (A); and lay two eggs, the size of those of a goose. The young are brought up in the nest till able to shift for themselves. They have but one nest in a year, which is in January or February, except the first eggs are taken away, when they make a second in April or May. The young birds are frequently eaten by the natives, though the colour of the flesh is very dark; that of the old ones is tough and ill tasted. By some authors this species is said to feed on crabs and birds, such as pigeons, poultry, and even to attack sheep and goats; but this is denied by others, who say that its principal food is reptiles. In the stomach of one which M. Bajon dissected, there were only found herbs and seeds of plants; however, he adds, that the bird has no gizzard. The cornuta is a rare species. It is found in certain districts in Cayenne, Guiana, Surinam, and other parts of South America, chiefly in the marshes and wet savannas, and for the most part near the sea. These should seem to be the birds mentioned by Ulloa (B), which are called by the inhabitants of Quito *dispertadores*, or "awakeners," from their giving notice to others of the approach of danger; as on hearing the least noise, or seeing any one, though at a great distance, they rise from the ground, and make a loud chattering like a magpie, continuing the noise, and hovering over the object which caused the alarm, whereby the rest of the birds, taking the hint, are able in time to escape the impending danger. This screaming noise, which some authors relate as being exceedingly loud and terrible (C), has occasioned Mr Pennant to give the genus the name annexed to it. In Dr Hunter's museum there is a fine specimen of this bird, brought from Cayenne.

Palamedea, Palamedes.

The second species of palamedea is the cristata, or crested screamer. This bird is about the size of a heron: the bill is short, bent like that of a bird of prey, and of a yellowish brown: the irides are gold-coloured: on the forehead, just above the bill, is a tuft of black feathers, variegated with ash-colour: the head, neck, and body, are gray, mixed with rufous and brown, most inclining to the last on the wings and tail: the wings are not furnished with spurs: the legs pretty long, of a dull yellow: claws brown; the hind toe placed high up, so as not to touch the ground in walking.

This bird inhabits Brasil. Linnæus makes it to belong to the screamer genus, perhaps from its cry; for it is said to be heard at a great distance, and is not unlike that of a hen turkey. None of our later writers seem to have seen it, all of them relying on Marcgrave both for description and figure. It is said to feed on the same food as the heron tribe: the flesh is good, and the bird by some kept tame.

PALAMEDES, a Greek chief, son of Nauplius king

(A) Authors differ. Bajon says, that it makes the nest both in thickets, at some distance from the ground, and often among the rushes. Fermin tells us, that it builds on high trees. See *Mem. sur Cay.* and *Descr. Surin.*

(B) Voy. Vol. II. p. 243.—Ulloa makes their size no bigger than that of a cock. He says, that the head is adorned with a tuft of feathers. Perhaps he may mean the next species.

(C) *Terribile voce clamitans.* Linnæus.

king of Eubœa, by Clemene. He was sent by the Grecian princes who were going to the Trojan war, in order to bring Ulysses to the camp, who, to avoid the expedition, pretended insanity; and the better to carry on the imposition, he often harnessed different animals to a plough, and sowed salt instead of barley. Palamedes soon discovered the cheat. He knew that regret to part with Penelope, whom Ulysses had lately married, was his only reason for pretending insanity; and to demonstrate this, Palamedes took Telemachus, of whom Penelope had lately been delivered, and put him before his father's plough. Ulysses turned the plough a different way, not to hurt his child. He was therefore obliged to attend the Greek princes to the war; but a mortal enmity took place between Ulysses and Palamedes. The king of Ithaca determined to take every opportunity to distress him; and when all his expectations were frustrated, he was mean enough to bribe one of his servants, and to make him dig a hole in his master's tent, and there conceal a large sum of money. After this Ulysses forged a letter in Phrygian characters, as from Priam to Palamedes. In the letter the Trojan king seemed to beg Palamedes to deliver into his hands the Grecian army, according to the conditions which had been previously agreed upon when he received the money. This forged letter was carried, by means of Ulysses, before the princes of the Grecian army. Palamedes was summoned, and made the most solemn protestations of innocence, but in vain. The money that was discovered in his tent served to corroborate the accusation and he was therefore found guilty by the whole army, and stoned to death. Homer is silent about the unfortunate fate of Palamedes; and Pausanias mentions, that it had been reported by some that Ulysses and Diomedes had drowned him in the sea as he was fishing on the coast. Philostratus, who mentions the tragical story as above related, adds, that Achilles and Ajax buried his body with great pomp on the sea shore; and that they raised upon it a small chapel, where sacrifices were regularly offered by the inhabitants of Troas. Palamedes was a man of learning as well as a soldier; and, according to some, he completed the alphabet of Cadmus by the addition of the four letters θ, ξ, χ, φ, during the Trojan war. To him also is attributed the invention of dice and backgammon; and it is said that he was the first who regularly ranged an army in a line of battle, and who placed sentinels round the camp, and excited their vigilance and attention by giving them a watchword.

PALARIA, among the Romans, a kind of exercise performed at a stake by the soldiers. The stake being fixed in the ground, and six feet high above it, the young undisciplined solders advanced against it, armed with a hurdle and cudgel, instead of a sword and shield, and went through all the rules of attack and defence, as if actually engaged with an adversary. Sometimes they stood at a distance, and attacked with missive weapons; at the same time using all the requisite motions for defending themselves, and warding off what might be thrown against them.

PALATE, in anatomy, the flesh that composes the roof, or the upper and inner part, of the mouth.

The palate has much the same structure with the gums; but it has also a great number of glands, discovered so early as the time of Fallopius: these are principally situated in the hinder part near the uvula, where it is pendulous, in the manner of a curtain, which part is called the *velum*, or *claustrum*, of the palate. The glands situated particularly in this part, secrete a mucous fluid, serving to lubricate the mouth and throat, and to facilitate deglutition: they have a great number of apertures there for the discharge of this humour into the mouth.



The great uses of this membrane are, to defend the bones of the palate from corrupting; and for preventing, by its claustrum or velum, the things to be swallowed from getting up into the nostrils.

PALATINATE, a province or signiory, possessed by a palatine.

PALATINATE of the Rhine, a province of Germany, divided into two parts by the Rhine, called the *Upper* and *Lower Palatinate*. The former lies in the circle of Bavaria, and belongs to the elector thereof; but the latter, in the circle we are now treating, belongs to the elector Palatine. The latter part is bounded to the east by the county of Katzenellnbogen, the archbishopric of Mentz, the bishopric of Worms, and part of the territory of the Teutonic order in Franconia; to the west by Alsace, the duchy of Deuxponts, the county of Sponheim, the duchy of Simmern, and certain districts of the electorate of Mentz; to the south by the duchy of Wurtemberg and the bishopric of Spire; and to the north by a part of the archbishopric of Mentz and the county of Katzenellnbogen. It contains 41 towns, besides several boroughs; and is about 100 miles in length, and 70 in breadth. The air is healthful, and the soil fruitful in corn, pasturage, wine, tobacco, and all sorts of pulse and fruits, particularly walnuts, chesnuts, and almonds. This country also breeds abundance of cattle, and is well watered by the Neckar, the Nahe, and the Rhine. In the last of these, near Germersheim and Selz, is found gold: the exclusive right of searching for which is farmed out by the elector. The state of religion hath varied greatly here since the Reformation, Lutheranism, and Calvinism having been uppermost by turns, till the electorate devolved to the Popish branches of the family, when Popery, with all its superstition and mummery, was established anew: so that the Protestant religion is now on a very precarious footing in the Palatinate, though most of the natives are still of that persuasion: but the two sects of Protestants, namely, the Lutherans and Calvinists, have greatly contributed to their own ruin, by their mutual jealousy and animosity, being no less rancorous against one another than against their common adversaries the Papists. The Lutherans reckon themselves 50,000 strong, and are possessed of about 85 churches; but not one half of their preachers and schoolmasters have a competent maintenance. The number of Calvinist clergy here is estimated at 500, and that of the Roman Catholics at 400. Besides schools and Jesuits colleges in this country, there is one university, namely, that of Heidelberg; but there is very little trade in it except in wine. Authors are divided about the origin of the name *Palatines*, or *Psalzgraves*, as the Germans call them; but it seems most likely to be derived from the *palatia*, or palaces, which the old Frankish and German kings and Roman emperors were possessed of in different parts of the country,

Palatinate.

country, and over which they appointed supreme stewards or judges, who are called *Palatines* or *Psalzgraves*. The countries where these Palatines kept their courts, were, from them, called *Palatinates*; which name came at last to be appropriated, by way of eminence, to this country, as being the most considerable of them. The ancient electoral line failing in 1685, the electorate devolved to Philip William duke of Neuburg; and upon the death of his second son Charles Philip, to the prince of Sultzbach. This elector has the title of arch-treasurer of the empire, as well as the elector of Brunswic Lunenburgh, and is the fifth in rank among the secular electors. He is also one of the vicars of the empire alternately with the elector of Bavaria, and enjoys many other prerogatives. In his own dominions, he disposes of all vacant benefices; but allows the ecclesiastical council, composed of two clergymen and two laymen, to present two candidates, of which he chooses one. He is also master of all the tithes in his dominions; but he either grants them to the clergy, or salaries in lieu of them, out of the revenues of the church. His title is Psalzgrave of the Rhine; arch-treasurer and elector of the holy Roman empire; duke of Bavaria, Juliers, Cleve, and Berg; prince of Mons; marquis of Bergen-op-Zoom; count of Veldens, Sponheim the Mark, and Ravensberg; and lord of Ravenstein. His quota to the army of the empire is 30 horse and 138 foot, or 914 florins monthly. To the chamber of Wetzlar he contributes, each term, 404 rixdollars, 82 kruitzers. There is an order of knighthood in this country, viz. that of St Hubert; the badge of which is a quadrangular cross pendant to a red ribbond, with a star on the breast. The whole of the elector's revenue, arising from the Palatinate, the duchies of Berg and Juliers, the seigniory of Revenstein, and the duchies of Neuburg and Sultzbach, hath been estimated at about 300,000l. *per annum*. The military establishment consists of several regiments of horse and foot, besides the horse and Swiss lifeguards: in time of peace he is said to maintain about 6000 men.—All the different courts and councils, usual in other countries for the different departments of government, are also to be found here.

In general, the Lower Palatinate has suffered more by the preceding wars with France than all the provinces of Germany put together during the space of 50 years; for the French have plundered the country, and demolished some of its first towns more than once. In the modern part of the Universal History, we have the following account of the rise of the Palatinate of the Rhine, under the history of Germany.

"Though Conrad the son of Everhard inherited from his father the duchy of Franconia, with the counties of Hesse and Alsace, he could not succeed him in the dignity of Count Palatine, because Otho had taken it from his father, and conferred it on Herman third son of Arnold duke of Bavaria: but as this honour was unattended with any solid advantage, the emperor began to annex to it the lands and castles situated on the Rhine, whence he acquired the title of Count Palatine of the Rhine: and, in process of time, these counts made great acquisitions by marriages, purchases, mortgages, and imperial donations, so as to form a very considerable province." The powers of counts palatine in the German empire have always been ample; we have this account of it in the same learned work.

Palatinate ‖ Palatine.

"When the counts palatine of the Rhine began to execute their office, they neither possessed on that river lands, cities, nor castles; but having by degrees made great acquisitions by marriages, purchases, agreements, imperial donations, or otherwise, they have at length formed a very considerable principality. We are told, that under the emperors of the house of Suabia, their authority and power increased greatly, though it was a gradual increase. Under the reign of the emperor Henry IV. the credit of the counts palatine was very considerable at the court; and by the German law, the count palatine of the Rhine enjoys not only during the absence of the emperor, but likewise during a vacancy of the empire, the right of the ban beyond the Rhine, to within a mile of the city of Metz, and as far as the ocean, as well as in Flanders. However, this right of the ban has not been granted to him by the emperors. There is likewise an ancient ordonnance, in which the office of count palatine is mentioned; it imports, that the count palatine is always by right the representative or lieutenant of the kingdom. Lastly, How great the power of the counts palatine was, may be understood from this, that in the election of Rodolphus of Hapsburgh, and in that of Henry VII. the other electors promised to acknowledge as emperor him whom he should name. Although, however, the power of the counts palatine had as it were secured to them the vicariate of the empire, nevertheless the emperors still reserved to themselves the right of establishing vicars." See BAVARIA.

PALATINATES *of* POLAND. Previous to the revolution in this unfortunate country, it was divided into palatinates; whether those will be now changed cannot at present be ascertained, though it seems likely. A Polish palatine is thus described in the Universal History:

"A palatine may be regarded as the governor of a province, who levies and leads the troops of his own jurisdiction to join the army of the republic. His civil power is likewise considerable, as he presides at the assemblies of his palatinate, rates the prices of all commodities and merchandise in the province, regulates the weights and measures, and judges and defends the Jews within his jurisdiction. This part of his function is particularly specified, that a set of men the most useful and industrious in Poland may not be oppressed; the king being likewise obliged, by his oath, to afford them the protection of the laws and his sovereignity. Under him is appointed a substitute or vice-palatine, who takes an oath to his superior, and must be possessed of a land estate to a certain value.

PALATINE, or COUNT PALATINE, a title anciently given to all persons who had any office or employment in the prince's palace: but afterwards conferred on those delegated by princes to hold courts of justice in the provinces; and on such among the lords as had a palace, that is, a court of justice, in their own houses.

*Counties* PALATINE *in England*.—Chester, Durham, and Lancaster, are called *counties palatine*. The two former are such by prescription, or immemorial cu-

stom; or, at least as old as the Norman conquest: the latter was created by King Edward III. in favour of Henry Plantagenet, first earl and then duke of Lancaster; whose heiress being married to John of Gaunt the king's son, the franchise was greatly enlarged and confirmed in parliament, to honour John of Gaunt himself, whom, on the death, of his father-in-law, the king had also created duke of Lancaster. Counties palatine are also called *à palatio;* because the owners thereof, the earl of Chester, the bishop of Durham, and the duke of Lancaster, had in those counties *jura regalia*, as fully as the king hath in his palace; *regalem potestatem in omnibus*, as Bracton expresses it. They might pardon treasons, murders, and felonies; they appointed all judges and justices of the peace; all writs and indictments ran in their names, as in other counties in the king's; and all offences were said to be done against their peace, and not, as in other places, *contra pacem domini regis*. And indeed by the ancient law, in all peculiar jurisdictions, offences were said to be done against his peace in whose court they were tried; in a court-leet, *contra pacem domini;* in the court of a corporation, *contra pacem ballivorum;* in the sheriff's court or tourn, *contra pacem vicecomitis*. These palatine privileges (so similar to the regal independent jurisdictions usurped by the great barons on the continent during the weak and infant state of the first feudal kingdoms in Europe) were in all probability originally granted to the counties of Chester and Durham, because they bordered upon enemies countries, Wales and Scotland: in order that the owners, being encouraged by so large an authority, might be the more watchful in its defence; and that the inhabitants, having justice administered at home, might not be obliged to go out of the county, and leave it open to the enemy's incursions. And upon this account also there were formerly two other counties palatine, Pembrokeshire, and Hexamshire, the latter now united with Northumberland: but these were abolished by parliament, the former in 27 Hen. VIII. the latter in 14 Eliz. And in 27 Hen. VIII. likewise, the powers before mentioned of owners of counties palatine were abridged; the reason for their continuance in a manner ceasing; though still all writs are witnessed in their names, and all forfeitures for treason by the common law accrue to them.

Of these three, the county of Durham is now the only one remaining in the hands of a subject. For the earldom of Chester, as Camden testifies, was united to the crown by Henry III. and has ever since given title to the king's eldest son. And the county palatine or duchy of Lancaster was the property of Henry of Bolingbroke, the son of John of Gaunt, at the time when he wrested the crown from King Richard II. and assumed the title of Henry IV. But he was too prudent to suffer this to be united to the crown; lest, if he lost one, he should lose the other also. For, as Plowden and Sir Edward Coke observe, "he knew he had the duchy of Lancaster by sure and indefeasible title, but that his title to the crown was not so assured: for that after the decease of Richard II. the right of the crown was in the heir of Lionel duke of Clarence, second son of Edward III.; John of Gaunt, father to this Henry IV. being but the fourth son." And therefore he procured an act of parliament, in the first year of his reign, ordaining that the duchy of Lancaster, and all other his hereditary estates, with all their royalties and franchises, should remain to him and his heirs for ever; and should remain, descend, be administered, and governed, in like manner as if he never had attained the regal dignity: and thus they descended to his son and grandson Henry V. and Henry VI.; many new territories and privileges being annexed to the duchy by the former. Henry VI. being attainted in 1 Edward IV. this duchy was declared in parliament to have become forfeited to the crown, and at the same time an act was made to incorporate the duchy of Lancaster, to continue the county palatine (which might otherwise have determined by the attainder), and to make the same parcel of the duchy: and, farther to vest the whole in King Edward IV. and his heirs, kings of England, for ever; but under a separate guiding and governance from the other inheritances of the crown. And in 1 Hen. VII. another act was made, to resume such part of the duchy lands as had been dismembered from it in the reign of Edward IV. and to vest the inheritance of the whole in the king and his heirs for ever, as amply and largely, and in like manner, form, and condition, separate from the crown of England and possession of the same, as the three Henries and Edward IV. or any of them, had and held the same.



The isle of Ely is not a county palatine, though sometimes erroneously called so, but only a royal franchise: the bishop having, by grant of King Henry I. *jura regalia* within the isle of Ely; whereby he exercises a jurisdiction over all causes, as well criminal as civil.

Palatine *Games*, in Roman antiquity, games instituted in honour of Augustus by his wife Livia, after he had been enrolled among the gods. They were celebrated in the palace, from whence the name, and were confirmed by the succeeding emperors.

Some authors say that these games were instituted in honour of Julius Cæsar, and others again confound them with the Ludi Augustales; but neither of these opinions seem to be well supported. See Augustales.

PALATINUS mons, or *Palatium*, the first mountain of Rome, occupied by Romulus, and where he fixed his residence and kept his court, as did Tullus Hostilius, Augustus, and all the succeeding emperors: and hence it is that the residence of princes is called *palatium*. The reason of the name is variously assigned: some say it is derived from the goddess Pales, or from the Palatini, who originally inhabited the place, or from *balare* or *palare*, the bleatings of sheep, which were frequent there; or perhaps from the word *palantes*, wandering, because Evander, when he came to settle in Italy, gathered all the inhabitants, and made them all one society. To the east it has Mount Cœlius, to the south the Aventine, to the west the Capitoline, and to the north the Forum.—*Palatinus*, the surname of Apollo from this place; where Augustus built a temple to that god, adorned with porticoes and a library, valuable for the various collections of Greek and Latin manuscripts which it contained.

PALATIUM (anc. geog.), a place in the territory of Reate, distant from it 25 stadia. Dionysius Halicarnasseus

carnaſſeus reckons it one of the firſt towns of the Aborigines; and from it Varro accounts for the name of the *Mons Palatinus;* namely, that a colony from Palatium ſettled there.

PALATIUM (Pliny), *Pallantium* (Pauſanias), *Palanteum* (Livy); *Pallanteum* (Solinus). This laſt is the true writing; the great grandfather of Evander, from whom it took its name, being called *Pallas*, not *Palas;* A town of Arcadia, which concurred to form Megalopolis (Pauſanias). From it the *Palatium*, or *Mons Palatinus*, takes alſo its name, according to Virgil and Pliny.

PALATIUM *Diocleſiani;* the villa of Diocleſian, near Salonæ, where he died, (Euſebius). Afterwards called *Spalatum;* which roſe to a conſiderable city from the ruins of Salonæ; ſituated in Dalmatia on the Adriatic. Now *Spalatto*, or *Spalatro.*

PALATIUM *Luculli*, (Plutarch), or *Villa Luculli;* a place between Miſenum and Baiæ in Campania, of wonderful ſtructure. Now in ruins, and called *Piſcina Mirabile.*

PALATO-SALPINGÆUS, } See ANATOMY, *Table*
PALATO-*Staphylinus*, } *of the Muſcles*, p. 708.

PALE, a little pointed ſtake or piece of wood uſed in making encloſures, ſeparations, &c. The *pale* was an inſtrument of puniſhment and execution among the ancient Romans, and ſtill continues ſo among the Turks. Hence empaling, the paſſing a ſharp pale up the fundament through the body.

PALE, in heraldry. See HERALDRY, p. 446.

PALEARIUS (Aonius), was a man of the greateſt probity, and one of the beſt writers of the 16th century. He gained the eſteem of the men of wit and learning of his time by a noble poem on the immortality of the ſoul. He was appointed profeſſor of polite literature at Sienna; where his tranquillity was diſturbed by conteſts with an envious colleague, and by the malicious aſperſions of his enemies; againſt which, however, his eloquence proved always a ſufficient defence. At laſt he left Sienna, and accepted the invitation of the magiſtrates of Lucca, who gave him ſeveral marks of their eſteem, and ſettled a conſiderable ſtipend upon him. Some years after, he removed to Milan; where he was ſeized by order of Pope Pius V. and carried to Rome. He was convicted of having ſpoken in favour of the Lutherans, and againſt the Inquiſition; and therefore was condemned to be burnt. This ſentence was executed in 1566. He wrote ſeveral pieces in verſe and proſe; of which the one above mentioned is the moſt eſteemed.

PALENCIA, a town of Spain, in the kingdom of Leon, with a rich archbiſhop's ſee. It had an univerſity, but it was removed to Salamanca. It is ſeated in a fertile ſoil, on the river Carion on the frontiers of Caſtile, in W. Long. 3. 7. N. Lat. 42. 10.

PALERMO, a city of Sicily, in the Val-di-Mazara, with an archbiſhop's ſee and a large harbour. "This city (ſays Mr Hill *), which is the capital of Sicily, is of great antiquity; and if a conjecture may be formed from its ancient name *Panormus*,' which ſignifies an univerſal harbour, it was formerly in a very flouriſhing condition. By whom it was founded is uncertain, nor have we any authentic accounts of its inhabitants till it became a colony of the Phœnicians, after which it paſſed into the hands of the various nations that became maſters of this iſland. The preſent city principally conſiſts of two wide, uniform, and well built ſtreets, each about a mile in length, croſſing each other at right angles in the centre, where there is a ſmall octagon ſpace, ornamented with four ſtatues."

* *Travels through Sicily and Calabria.*



Moſt of the cities of Sicily have ſurnames: Palermo is denominated *the happy*. It has gained this epithet, no doubt, on account of the advantages of its ſituation. It has two harbours: in the one, which is very large, and in which there is a mole 1300 paces in length, ſhips lie at anchor; in the other their cargoes are laden and unladen. Both the harbours open to the weſt: there is alſo a ſuperb quay which extends a mile from weſt to eaſt, in a rectilinear direction, and is called *La Marine.* The proſpect is, on the one ſide, loſt in the wide expanſe of the ocean, and on the other confined by the walls of the city; the walls appear adorned with pilaſters, and crowned with a row of balluſtrades through which the eye diſcovers a long range of palaces. Theſe objects altogether form a delightful ſpectacle. Indeed nothing can be more picturesque than the bay of Palermo. It forms a large amphitheatre, with the capital of Sicily in the centre; ſurrounded for ſome miles by a moſt delightful country, and encloſed by romantic rocks and mountains. The town was formerly ſurrounded by a ſtrong wall; but the fortifications are now entirely neglected, except towards the ſea, where there are ſtill a few weak works. The quay is the principal public walk here. Palermo is embelliſhed all round with avenues of trees, and has four principal entrances, facing the four cardinal points, which are at the extremities of the two ſpacious ſtreets which croſs each other. The moſt frequented of theſe two ſtreets is called *Caſſero.* It begins where the quay ends, with the north gate called *Porta Felice*, the happy gate; and terminates on the ſouth, at the new gate, which opens on the road to Montreale. Near the laſt of theſe gates, this city, which ſo well merits the attention of a lover of the arts, exhibits a large ſquare, round which ſtand ſome extenſive monaſteries, the palace of the archbiſhop, and the palace of the viceroy. Directly oppoſite to the palace of the viceroy ſtands, on a pedeſtal richly ornamented with a variety of figures, a ſtatue of Philip IV. The ſtatue, the pedeſtal, and the ornaments, are all of marble.

Palermo is quite filled with public monuments, churches, monaſteries, palaces, fountains, ſtatues, and columns. Theſe are not all eminently beautiful; for they have not been all erected under the reign of *good taſte;* but every one of them ſhows that the nation is fond of the arts, and poſſeſſes a genius for decoration. Spring waters are very copious in this city. Not a quarter in Palermo but is liberally ſupplied with fountains, moſt of which are marble, all of them adorned with pieces of ſculpture, and all afford large quantities of water.

The ſituation of this city is truly happy; the ſea, the hills, the lofty mountains, preſent on all ſides beautiful and ſtriking proſpects, which render it one of the moſt favourable ſituations for the genius of the artiſt, whoſe object is to copy the beauty and ſublimity of nature. Freed from the fetters of the Inquiſition, the abolition of which was procured by the marquis of Caracciolí, and from the influence of ſome other

Palermo. other unfavourable institutions, which are rapidly declining, Palermo must become one of the finest cities in the world; and the island of which it is the capital, being all cultivated like a garden, one of the most enchanting spots on the face of the earth. Nature has denied none of her best spots to Sicily. It was the benignity of nature, which, in the happy ages of antiquity, when the political circumstances of the Sicilians were not such as to repress their genius, prompted and enabled them to erect so many illustrious monuments. "Adjoining to the town, and near the sea, is a public garden or promenade, planted with orange and lemon trees, formed into arcades, and now loaded with fruit §; the stems of the trees stand in furrows, and are continually watered by a small stream. In the middle is a fountain, on which stands a colossus of white marble, surrounded by four grotesque temples, in two of which are canary birds. Among the oranges is a kind called *sanguinei* or bloody, which are stained in the middle with red, and have usually the finest flavour. Some of the lemons are sweet, but very flat, tasting like sugar and water. The citrons grow to an immense size; the rind, which occupies at least three fourths of the bulk of the fruit, is eaten with sugar; the juice is sharper than the sourest lemon. Indian figs in very great abundance grow wild in the fields and hedges, to the height of twelve or fourteen feet; of these there are three kinds, one with large spines, another with smaller, and the third almost smooth. Their fruit is cooling and delicious, 10,000l. worth of which is sold annually to the poor people in the neighbourhood of this city. Another plant, very common in this country, is the aloe, which usually blossoms every fifth or sixth year. Of these there are five or six species, which grow mostly in the hedges, and together with the Indian figs, form a most impenetrable fence.

§ February.

"The palace, which is an indifferent old building, is situated in a square, near the south gate of the city, and commands a delightful prospect of the adjacent country. At the top is an observatory, inhabited by an ingenious old priest who has been in England, and brought from thence several astronomical instruments constructed by Ramsden." Neither the structure, situation, nor architectural ornaments of the palace are such as to merit any extraordinary praise. It is, like many others an assemblage of buildings erected in various ages, as need of accommodation or fancy suggested; and, of consequence, it must unavoidably be defective in architectural order and beauty. The chapel is the only part of it that merits any attention. It was founded by the Counts Roger, the Norman conquerors of Sicily. Within, it is decorated with beautiful pieces of marble and porphyry, and of Mosaic work in gold and various colours. It is in the same taste with the cathedral of Montreale. It is built on the same plan with common churches, only on a smaller scale. The nave is encircled with pillars; on the right and the left are two narrower openings, called *lateral* or low passages: the choir and sanctuary are at the end of the nave. Among all the pillars which enclose the nave, it would be hard to find two exactly of the same form and workmanship. Opposite to a channelled column stands another on which the graving tool has made no such impressions; several have neither astragal, nor base, nor scale: they are formed of various kinds of marble, and are of different orders and unequal in height. The walls, the arcades, and the arches, are covered with Mosaic work, in gold and colours, representing angels, and male and female saints.

Over the entrance into the choir, and fronting the nave, there is an Eternal Father of a huge size; the design of which has, in all probability, been to impress the beholder with a sufficiently awful idea of the greatness of God. Such representations of the deity, however improper, not to say impious, occur pretty commonly in the churches of Sicily. The cathedrals of both Montreale and Palermo display the Divine Majesty with equal dignity. Over the walls of the chapel there are many pieces of granite, porphyry, and serpentine, cut into a round, or a square, or some other form, and set like panes of glass. Their edges are encircled with various draughts in gold and colours; decorations unquestionably expensive, as they are indeed very finely executed in their kind. But it is amazing that such irregularity of design was admitted in a building of such magnificence and raised at such an enormous expence. The pavement of the chapel has been originally laid, and still consists in part of large blocks of tin, porphyry, and serpentine. Most of these are round; ornamented with compartments of draughts, and covered over, as well as the walls, with incrustations of coloured Mosaic work. The seat designed for the viceroy is of the same kind, and highly ornamented. The candlestick intended to receive the wax lights at the festival of Easter is of white marble. All the riches of sculpture are lavished on it with such profusion as renders it a prodigy of labour; but in a fantastic unnatural taste.

In a long gallery in the palace of the viceroy, stand two figures of rams in bronze, concerning which we find the following tradition.—Archimedes is said to have long ago erected in one of the public squares of Syracuse four columns with a brazen ram upon the top of each. He is said to have placed them there in such a posture, as that some one of them always indicated which of the four principal winds was blowing; and it is added, that they were fabricated with such art, that the wind caused them to utter sounds exactly similar to the bleating of sheep; and whenever any one of the four bleated, he thereby gave notice that the wind was blowing from that quarter towards which he stood. It is certain (as travellers inform us) that the two brazen rams in this gallery are perforated with small holes in their flanks, close to their thighs, and in other places over their bodies; and that by blowing through those holes a sound is produced pretty much like the bleating of sheep. The wind appears to pass through the holes, and to issue out at the mouth: there might, however, be other holes in the pedestal on which the ram stood, or in other parts of the body, which might contribute to produce the bleating; for travellers agree in saying, that those which they could observe do not appear to be sufficient to produce the effect. The prince of Torre Muzza, one of the most enlightened men in Sicily, informed M. Houel, that these two rams were dug up from among the ruins of Syracuse in the fourteenth century: as they were buried under ground, they had probably lain there for many centuries. They were bought by the Marquis Geraci, of the family of Ventimiglia, and lay long in his

Palermo. his castle. About the end of the fifteenth century they were brought to Palermo, and placed in the palace of the viceroy. It is not known what is become of the other two. They are probably buried in some ancient ruins, and may be one day or other discovered in digging for the foundation of some new building. The proportions of these two rams are larger than nature. They are pieces of very fine workmanship: both the heads and the horns are formed with taste, delicacy, and truth; the wool is not so well executed; the forms all together are not absolutely the finest that might be selected from among the whole species.

The cathedral of Palermo is dedicated to St Rosalia. The Sicilians, though so exceedingly devout, have however neglected to repair it; and it is at present in a most miserable state, as the interior parts appear to be falling into ruins. Proposals have been made for rebuilding it, and various plans have been shown.

The present church appears to have been built by the Counts Roger. The external parts are in a Gothic taste, and very heavy: within, it has been at different periods repaired and embellished. The pillars of the nave are adorned with pilasters of the Corinthian order: these are joined by arches through which you pass to the sides of the building. In some places it is overloaded with ornaments, in others but very poorly ornamented: viewed all together, it is so destitute of order or proportion as to be absolutely ridiculous.

In a chapel on one side of the cathedral are four Gothic tombs of the same period. They have been originally sarcophagi; and having escaped the fate of most of the other works of antiquity, have been spoiled by attempts to repair or improve them, and have been set up here to preserve the remains of some of the kings of Sicily. The only thing about them that can deserve attention is the beauty of the stone; they are of a fine red porphyry.

In the same chapel there is a fine large tabernacle; the whole of which, when viewed without distinction of the parts, resembles the dome and the front gate of the Val-de-grace at Paris. It is of rich lapis lazuli, of the very finest colour. The whole of it is plated, and the pillars are said to be solid. All its ornaments are of gilt brass; and on the whole it is extremely beautiful.

Around the church are several statues of saints by Guagini, the celebrated sculptor. On the way from the cathedral down the Cassero there is, on the right hand, a small square, at the entrance of which stands a pedestrian statue of Charles V. in bronze. Near the place where the two great streets cross stands the senate house, in a small court, before which there is a fine marble fountain; there are besides about this edifice many curious fragments of antiquity. It would extend this article beyond all proportion if we were to mention all the curiosities which are to be found in Palermo. We shall now endeavour to give our readers an idea of the internal government of the place, which we shall do in the words of Mr Hill.

"The magistrates appointed to preserve the order of society in this city are, first, the supreme judge, to whom belongs the administration of justice in criminal cases: he is the head of the nobility, and immediately follows the viceroy in all the solemn functions. Secondly, The prætor, who regulates the affairs of the city. He is the perpetual deputy of the kingdom; chief in parliament of the order to whom appertains the right of regulating the king's demesne, and possessed of the prerogative of captain-general during the absence of the viceroy. Thirdly, The prætorian court, which consists of three judges, citizens of Palermo, who are chosen annually by the king. They assist the supreme judge in the decision of criminal affairs, and the prætor in the deliberations upon the finances; these two officers, however, have neither vote nor signature, except the prætor, in the business respecting the public bank and first fruits. Fourthly, The senate of Palermo, composed of the prætor and six practitioners of the law, named by the king, who wear the toga after the manner of the ancient Roman senators, and principally inspect the police which regards the grain and provisions. There are besides seven great officers of state, to each of which is assigned a peculiar employment. First, *Il Maestro Portolano*, to whom is committed the care of the public granaries, and who manages the sale of the corn both at home and abroad. The imposition of a tax upon this commodity has nearly proved the ruin of agriculture, especially as the exportation of it is prohibited to all those who are not able to pay an exorbitant price for that privilege. The quantity of corn annually produced in the island does not at present amount to more than a tenth part of what was collected in former years. Secondly, The auditor general, who passes judgment without appeal upon all offences committed within the precincts of the palace. Thirdly, The high admiral, whose jurisdiction extends over the marine. Fourthly, The chancellor, who overlooks all the notaries of the kingdom, prepares all official patents, reads the propositions when the parliament assembles, and at the time of a coronation tenders the oath of fidelity to the people, and also proclaims that of the monarch, who thereby binds himself to maintain and defend the privileges of the city of Palermo. The same ceremony takes place upon the installation of a viceroy. Fifthly, The prothonotary of the queen's chamber, who has the inspection of the demesnes of six cities, *viz.* Syracuse, Lentini, Carlentini, St Filippo, Mineo, and Virini, which were formerly appropriated to the queens of Sicily. Sixthly, The chief secretary, who presides over the officers appointed to receive the taxes and duties in the places of their respective jurisdictions. And, seventhly, The lieutenant of the royal exchequer, who has the administration of all effects that have been sequestered or confiscated.

"Palermo is the principal residence of the greater part of the Sicilian nobility; and as it is not the custom for any gentleman to walk in the streets, at least 1000 carriages are said to be kept in the town. They are for the most part in the English taste, very elegant, shown to the greatest advantage, with beautiful horses richly caparisoned, and as many footmen in splendid liveries as can be crowded together behind. Every evening all the people of rank drive about in this manner on the grand public terrace by the sea side. There are also very convenient hackney coaches, covered and open, waiting all day in their respective stations."

Palermo.

It is very remarkable, that the dead in Palermo are never buried. Captain Sutherland gives the following account of this circumstance in his Tour to Constantinople. The dead bodies are carried to the Capuchin convent, which is one of the largest in Italy; "wh e, after the funeral service is performed, they are dried in a stove heated by a composition of lime, which makes the skin adhere to the bones. They are then placed erect in niches, and fastened to the wall by the back or neck. A piece of coarse drab is thrown over the shoulders and round the waste; and their hands are tied together, holding a piece of paper with their epitaph, which is simply their names, age, and when they died. We of course (says Captain Sutherland) visited this famous repository; and it is natural to suppose that so many corpses would impress one with reverence and awe. It was nearly dusk when we arrived at the convent. We passed the chapel, where one of the order had just finished saying vespers, by the gloomy glimmering of a dying lamp. We were then conducted through a garden, where the yew, the cypress, and the barren orange, obscured the remaining light; and where melancholy silence is only disturbed by the hollow murmuring of a feeble water fall. All these circumstances tuned our minds for the dismal scene which we were going to behold; but we had still to descend a flight of steps impervious to the sun; and, these at last, conveyed us to the dreary mansion of the dead. But (will you believe me?) notwithstanding the chilling scene through which we had passed, notwithstanding our being in the midst of more than a thousand lifeless bodies, neither our respect for the dead, nor for the holy fathers who conducted us, could prevent our smiling. The physiognomies of the deceased are so ridiculously mutilated, and their muscles so contracted and distorted in the drying, that no French mimic could equal their grimaces. Most of the corpses have lost the lower part of the nose; their necks are generally a little twisted; their mouths drawn awry in one direction, their noses in another; their eyes sunk and pointed different ways; one ear perhaps turned up, the other drawn down. The friars soon observed the mirth which these unexpected visages occasioned; and one of them, as a kind of *memento*, pointed out to me a captain of cavalry, who had just been cut off in the pride of his youth: but three months ago, he was the minion of a king—the favourite of a princess—Alas! how changed! Even on earth there is no distinction between him and the meanest beggar. This idea in a moment restored my reflection; and I felt with full force the folly of human vanity. I turned to the holy father, who gave me this lesson. His eyes were fixed on what was once a captain of horse—I saw in them, 'Read this, titled pomp, and shrink to thy original nothingness. Hie thee to my lady's chamber, tell her, though she paint an inch thick, to this must she come at last—make her laugh at that.' The relations of the deceased are bound to send two wax tapers every year for the use of the convent; in default of which, the corpse is taken down and thrown into the charnel house. Were it not for the number of vacancies occasioned by the nonpayment of this stipend, the Capuchins would be unable to find niches for the number of men who must die every year in so populous a city as this. Women are dried as well as the men, but are not exposed. Nobles are shut up in chests."

Pales, Palestine.

The number of the inhabitants is above 200,000; and the harbour though very large, is not so commodious as might be expected, and the vessels that ride therein are not always very safe. There is a magnificent castle built near the sea side, wherein the viceroy resides six months in the year; and his presence draws a great number of nobility to this place. This city has suffered greatly by earthquakes, particularly in 1693; and it was greatly damaged by a fire in 1730, when a magazine of powder was blown up, containing 400 tons. It stands in a pleasant fruitful country, on the north-east coast of the island, and at the bottom of the gulf of the same name. E. Long. 13. 23. N. Lat. 38. 15.

PALES, in Pagan worship, the goddess of the shepherds, to whom they offered milk and honey, in order that she might deliver them and their flocks from wild beasts and infectious diseases. This goddess is represented as an old woman. She was worshipped with great solemnity at Rome; and her festivals, called *Palilia*, were celebrated on the 21st of April, the very day that Romulus began to lay the foundation of the city of Rome; the ceremonies of which consisted in burning heaps of straw, and leaping over them. No sacrifices were offered, but purifications were made with the smoke of horses blood, and with the ashes of a calf that had been taken from the belly of its mother after it had been sacrificed, and with the ashes of beans. The purification of the flocks was also made with the smoke of sulphur, of the olive, the pine, the laurel, and the rosemary. Offerings of mild cheese, boiled wine, and cakes of millet, were afterwards made to the goddess. Some call this festival *Parilia, quasi à pariendo*, because the sacrifices were offered to the divinity for the fecundity of the flocks.

PALESTINE, in its present state, is a part of Asiatic Turkey, situated between 31° 30′ and 33° 20′ north latitude, and between 34° 50′ and 37° 15′ east longitude. It is bounded by Mount Libanus, which divides it from Syria, on the north; by Mount Hermon, which separates it from Arabia Deserta on the east; by the mountains of Seir and the deserts of Arabia Petræa, on the south; and by the Mediterranean sea on the west.

This once fertile and happy spot was first called the land of *Canaan*, or *Chanaan*, from Noah's grandson. In Scripture, however, it is frequently distinguished by other names; such as the *Land of Promise*, the *Land of God*, the *Land of Israel*, &c. It received the name of *Palestine* from the *Palestines* or *Philistines*, who possessed a great part of it; and it had the name of *Judea*, or *Judea Palestina* from *Judah*, the most considerable of the twelve sons of Jacob. The Christians have denominated it the *Holy Land*; partly on account of the many singular blessings it received from the Divine Providence, and partly on account of its metropolis being made the centre of God's worship and his peculiar habitation; but much more for its being the place of our Saviour's birth, the scene of his preaching and manifold miracles; especially the place in which he accomplished the great work of our redemption. As to the name of *Judea*, it did not begin to receive that till after the return of the Jews from the Babylonish

nish captivity, though it had been styled long before the *Kingdom of Judah*, in opposition to that of *Israel*, which revolted from it under Jeroboam, in the reign of Rehoboam the son of Solomon. But after the return, the tribe of Judah, the only one that made any figure, settling at Jerusalem, and in the countries adjacent, quickly gave its name to the whole territory. By profane authors it was called by many different names; such as Syria, Palestina Syria, Cœlosyria, Iduma, Idumæa, and Phœnicia or Phœnice; but these are supposed only to have been given out of contempt to the Jewish nation, whom they looked upon as unworthy of any other name than what distinguished the most obscure parts of the neighbouring provinces.

That part of the country which was properly called the *Land of Promise*, was enclosed on the west by the Mediterranean; on the east by the lake Asphaltites, the Jordan, the sea of Tiberias or of Galilee, and the Samachonite lake; to the north it had the mountains of Libanus, or rather of Antilibanus, or the province of Phœnicia; and to the south, that of Edom or Idumæa, from which it was likewise parted by another ridge of high mountains. The boundaries of the other part, which belonged to the two tribes and a half beyond the river Jordan, are not so easily defined, as well as those of the conquests made by the more prosperous kings of the Jews. All that can be said with any probability is, that the river Arnon was the first northern boundary on that side; and with respect to those on this side the Jordan, there is a considerable disagreement between the Hebrew and Samaritan versions of the Pentateuch.

The extent of this country is likewise variously settled by geographers; some giving it no more than 170 or 180 miles from north to south, and 140 in breadth where broadest, though not much above half that breadth where narrowest. But from the latest and most accurate maps, it appears to extend near 200 miles in length, and about 80 in breadth about the middle, and about 10 or 15, more or less, where it widens or contracts.

The climate is certainly very happy, its situation being neither too far south nor too far north. The longest day is not above 14 hours 15 minutes: But the limits of Palestine appear so small, considering that the country is likewise intersected by high ridges or mountains, woods, deserts, &c. that many learned men have been induced to question what we read of its fertility and populousness in former times. It must be owned, indeed, that when we compare its ancient and flourishing state, when it was cultivated with the utmost diligence by persons well skilled in every branch of agriculture, with what it has been since the total extirpation of the Jews out of it, and more especially since it fell into the hands of the Turks, the contrast is amazingly great: but when we consider the many evident causes which have contributed to effect this change, and even yet consider the nature of the country itself, we find not the least reason to doubt the truth of what the sacred historians have related. Moses describes the richness of it in the strongest terms, even before the Israelites got possession of it. It even exceeded the land of Egypt, so much celebrated by ancient historians; especially in the vast numbers of cattle which it produced; in the quantity and excellence of its wine, oil, and fruits. With respect to the oil and fruits, it is plain, that the olives and oil of Canaan exceeded in goodness those of Egypt, since the tribes sent them thither from thence; and as for vines, Herodotus tells us, that the Egyptians had none at all, but supplied the want of them by a liquor brewed from barley. The presents which Jacob sent to his son Joseph, of honey, spices, myrrh, almonds, and other fruits of Palestine, show that they must have been much better in the land of Judea than in Egypt. The wines of Gaza, Ascalon, and Sarepta, were famous among the most remote nations; though it is allowed, that the wine which was made at and in the neighbourhood of Bethlehem, in great quantities, was equal at least, if not superior, to any of the rest: and that of Libanus, mentioned by the prophet Hosea, was no less celebrated for its excellent flavour.

Several circumstances contributed to this wonderful fecundity: such as, the excellent temperature of the air, which was never subject to excessive heats or colds; the regularity of its seasons, especially the former and latter rain; and the natural fatness and fertility of its soil, which required neither dunging nor manuring, and could be ploughed with a single yoke of oxen and a small kind of plough; for the soil was, and is still, so shallow, that to have gone deep into it, would rather have endangered than improved the crop. With respect to the excellency of its corn, we are told, that the bread of Jerusalem was preferred above all other; and the tribe of Asher produced the best of both, and in greater quantity than any other tribe; and such plenty was there of it, that, besides what sufficed the inhabitants, who made it their chief sustenance, Solomon, we read, could afford to send 20,000 cors, or measures, of it, and as many of oil, yearly, to Hiram king of Tyre; besides what they exported into other countries. And we find, even so late as King Herod, surnamed Agrippa, the countries of Tyre and Sidon received most of their sustenance from his tetrarchy.

As to their fruits, the grapes were delicious, finely flavoured, and very large. The palm tree and its dates were in no less request; and the plain of Jericho, among other places, was famed for the great plenty and excellence of that fruit; insomuch, that the metropolis of that territory was emphatically styled *the city of palm trees*. But what both this plain, and other parts of Palestine, were most celebrated for, was the balsam shrub, whose balm was esteemed so precious a drug among the Greeks, Romans, Egyptians, and other nations, and is still to this day under the name of *balm of Gilead*. They had likewise the greatest variety of other fruit trees in the highest perfection; and which might be, in some sense, styled *perpetual*, because they were not only covered with a constant verdure, but because the new buds always appeared on the same boughs before the old fruit was ripe; and of those buds, which were in too great quantities to be allowed to come to maturity, they gathered enough to make very delightful pickles and sweetmeats, especially of their citrons, oranges, and apples of paradise, which last commonly hung by hundreds in a cluster, and as big as hens eggs, and of an excellent taste and flavour. Their vines yielded grapes twice, and sometimes three times, a year, great quantities of which were dried up, and preserved for use, as

well

well as their figs, plums, and other fruits. They had plenty of honey; the very trees distilled it; and the rocks yielded it in great quantities: but whether that of the latter kind was there deposited by the industrious bees, or produced some other way, is much disputed by travellers and naturalists. They likewise cultivated sugar canes in great abundance; and the cotton, hemp, and flax, were mostly of their own growth and manufacture, except some of a finer sort, that were brought to them from Egypt, and worn by those of the higher rank. Their vicinity to Libanus made the cedars, cypresses, and other stately fragrant trees, very common in most parts of the land, but more especially in Jerusalem. Cattle, both large and small, they fed in vast quantities; and the hilly countries not only afforded them variety and plenty of pasture, but also of water, which descended thence into the valleys and low lands, and fertilized them to the degree we have seen; besides several other rivers and brooks, some of the most remarkable of which we shall speak of in their proper places. But the most fertile pasture grounds were those on each side the river Jordan; besides those of Sharon, or Sarona, the plains of Lydda, Jamnia, and some others then justly famed for their fecundity. As for fish, the rivers abovementioned, the lake of Tiberias, and the Mediterranean sea, afforded, as they do to this day, great plenty and variety. Vast quantities were brought to Jerusalem, on which the inhabitants mostly subsisted; and hence one of the gates of that metropolis was, according to St Jerome, called the *fish gate*. The lake Asphaltites yielded salt in abundance, wherewith to season and preserve their fish, which Galen affirms to have been preferable to any other for wholesomeness, digestion, and extenuation. In short, the Scripture is so pregnant with proofs of the extraordinary richness and fecundity of this once happy land, and the vast number of people that lived in it, almost wholly upon its product, to say nothing of the vast exports of its corn, wine, oil, raisins, and other fruits, &c. that a man must have taken a strange warp to infidelity, that can call it in question, merely on account of the melancholy and quite opposite figure it now makes under its present tyrannical government.

But its fertility has been called in question; and Voltaire and other infidel writers have raised difficulties and objections against the authority of Scripture, from the pretended sterility of the land of Judea. In answer to which, the Abbé Guenée, about the year 1780, communicated to the Academy of Inscriptions and Belles Lettres at Paris, *Two Memoirs concerning the Fertility of Palestine*, in order to show that such objections had no solid foundation.

In the first of them, the author proves, that from the captivity of Babylon to the war of Adrian, Judea was always considered as a rich and fertile country. The positive and multiplied authorities of the writers of that period, Jews, Greeks, and Romans, not only attest in general the fertility of that country, but many of these writers, entering into a particular detail of circumstances, prove it from the nature of the climate, the qualities of the soil, and the excellencies and variety of its productions. These are confirmed ... of another kind, but which are of a very convincing nature, even those resulting from a great number of medals struck under the reigns of the kings of Syria and Judea, and under the Romans, both by Jews and Pagans, and which all bear the symbols of a rich fertility. To these proofs are added a multitude of facts, recorded in the history of the Jews during this period; the efforts of the neighbouring kings to conquer their country; the long and bloody wars that the Jews carried on with vigour, and sometimes with success, against powerful princes and nations; the tribute and taxes they paid to the kings of Egypt and Syria, to the Romans, and to their own princes; the magnificence of their sovereigns, and among others of Herod; the troops he raised and kept on foot; the temples, fortresses, palaces, and cities, which he erected and embellished, not only in his own country, but also in Syria, Asia Minor, and even in Greece; the immense sums he lavished among the Romans, the donations he made to his own people, and the vast treasures which he left behind him: all these circumstances concur in proving the fertility and riches of Palestine during that period.

In the second memoir, the Abbé Guenée considers the state of Palestine as it was from the time of the emperor Adrian to the caliphate of Omar, which comprehends a period of four centuries. From sundry facts he shows, that it could not then have been the barren country which it has been represented by some sceptical writers. He particularly mentions the project formed by Adrian of rebuilding and embellishing Jerusalem, of forming it into a Roman colony, and giving it his own name; a project of which he could never have entertained a thought, if Judea, which he had seen and examined with his own eyes, had appeared to him such a barren and wretched country, as it is said to be by some who have neither seen that country nor examined the matter with care and attention. Our author also produces a variety of other facts, to show that Judea, after all that it had suffered from the desolations of war both in ancient and latter times, still remained at the period in question fertile, rich, and populous. This is the idea which the writers of the time, Pagan and Christian, as well as Jewish, have given of Palestine. Antoninus Martyr, a citizen of Placentia, who in the 6th century travelled to Palestine, and composed an account of his voyage, which is still extant, says, that the canton of Nazareth was not inferior to Egypt in corn and fruits; and that though the territory of that city was not very extensive, it abounded in wine and oil, and excellent honey. The country about Jericho appeared to him still more fertile. He saw Mount Tabor, which he represents as surrounded with cities: and he observed, in the neighbourhood of Jerusalem, vineyards, great plantations of fruit trees, and through the whole country a considerable number of hospitals, monasteries, and beautiful edifices. Our learned abbé, in concluding his work, acknowledges, that the opulence and fertility of Judea might begin to diminish towards the middle of the period treated of in his second memoir: but he does not think that any argument can be drawn from hence against its having been at the commencement of this period in a flourishing state; and much less can any proof be brought from hence, that in preceding periods,

Palestine. riods, under the kings, or under the administration of Moses, the country of Palestine was a barren and uncultivated district.

Besides, it ought to be considered, that it was then inhabited by an industrious people, who knew how to improve every inch of their land, and had made even the most desert and barren places to yield some kind of productions, by proper care and manure: so that the very rocks, which now appear quite bare and naked, were made to produce corn, pulse, or pasture; being, by the industry of the old inhabitants, covered with mould, which, through the laziness of the succeeding proprietors, has been since washed off with rains and storms. We may add, that the kings themselves were not above encouraging all kinds of agriculture, both by precept and example; and, above all, that they had the divine blessing promised to their honest endeavours and industry: whereas it is now, and hath been long since, inhabited by a poor, lazy, indolent people, groaning under an intolerable servitude and all manner of discouragements; by which their aversion to labour and agriculture, farther than what barely serves to supply their present wants, is become in a manner natural and invincible. We may farther observe, after the judicious Mr Maundrell, that there is no forming an idea of its ancient flourishing state, when under the influence of heaven, from what it is now under a visible curse. And, if we had not several concurring testimonies from profane authors, who have extolled the fecundity of Palestine, that single one of Julian the Apostate, a sworn enemy to Jews and Christians, as well as to all the sacred writings, would be more than sufficient to prove it; who frequently makes mention, in his epistles, of the perpetuity, as well as excellence and great abundance, of its fruits and product. The visible effects of God's anger, which this country has felt, not only under Titus Vespasian (when myriads of inhabitants were either slain, or perished by the most severe famine, pestilence, and other calamities, and the rest sold for slaves into all lands; and new colonies sent to repeople it, who found it in such a desolate state, as quite discouraged them from restoring it to its pristine fruitfulness); but much more since that emperor's time, in the inundations of the northern barbarians, of the Saracens, and of the more cruel and destructive Christians during the crusades; and in the oppression it now feels under the Turkish yoke; may be easily owned to be more than sufficient to have wrought the dismal change we are speaking of, and to have reduced the far greater part into a mere desert.

Nevertheless, if we may credit those who have viewed it in this doleful condition, they will tell us, there are still such visible signs of its natural richness and fertility, as plainly show, that the bare want of culture is the main if not the only cause of its present poverty and barrenness. We shall hint, as a farther proof of this, what a learned traveller hath lately written of it from his own observations.

"The Holy Land (says Dr Shaw), were it as well peopled and cultivated as in former times, would still be more fruitful than the very best part of the coast of Syria and Phœnice; for the soil is generally much richer, and, all things considered, yields a preferable crop. Thus the cotton that is gathered in the plains of Ramah, Esdraelon, and Zabulun, is in greater esteem than what is cultivated near Sidon and Tripoli. Neither is it possible for pulse, wheat, or any sort of grain, to be more excellent than what is sold at Jerusalem. The barrenness, or scarcity rather, which some authors may, either ignorantly or maliciously, complain of, doth not proceed from the incapacity or natural unfruitfulness of the country, but from the want of inhabitants, and the great aversion there is to labour and industry in those few who possess it. There are, besides, such perpetual discords and depredations among the petty princes who share this fine country, that, allowing it was better peopled, yet there would be small encouragement to sow, when it was uncertain who should gather in the harvest. Otherwise, the land is a good land, and still capable of affording its neighbours the like supplies of corn and oil which it is known to have done in the time of Solomon."

Volney's Travels, Vol. II.

And Volney, in his Travels in Egypt and Syria, observes, that though the whole of Palestine is almost an entire level plain, without either river or rivulet in summer, and only watered by the winter torrents, the soil is yet good, and may even be termed fertile; so when the winter rains do not fail, every thing springs up in abundance; and the earth, which is black and fat, retains moisture sufficient for the growth of grain and vegetables during the summer. More doura, sesamum, water melons, and beans, are sown here than in any other part of the country. They also raise cotton, barley, and wheat; but though the latter be most esteemed, it is less cultivated, for fear of too much inviting the avarice of the Turkish governors and the rapacity of the Arabs.

Judea, in its largest sense, was divided into maritime and inland, as well as into mountainous and champain; and again subdivided into Judea on this side, and Judea beyond Jordan. But the most considerable division is that which was made among the twelve tribes, by lot, to prevent all murmuring and discontent among that stubborn people †; of these, two and a half were seated beyond Jordan, and the rest on this side. The next remarkable division was made by King Solomon, who divided his kingdom into twelve provinces or districts, each under a peculiar officer; and every one of these was to supply the king with provisions for his household in his turn; that is, each for one month in the year ‡. But the most fatal division of all was that which obtained under his imprudent son Rehoboam; when ten of the twelve tribes revolted, under the conduct of Jeroboam, who became head of this new monarchy, styled *the kingdom of Israel*, in opposition to that of *Judah*, the title which distinguished the maimed kingdom of Rehoboam from that time downwards. Under the second temple the distinction lasted a considerable time, and the same bloody hatred and hostilities continued between these two kingdoms; that of Israel taking the name of *Samaria* from its capital. The inhabitants were a mixture of the old Israelites, and of new colonies sent thither by the kings of Assyria after their conquest of it, till they were subdued by the Maccabees, and their metropolis destroyed. Under the Romans it began to be divided into tetrarchies and toparchies: the larger were those of Judea, Samaria, and Galilee, Upper and Lower; the lesser, those of Geraritica, Sarona, and others of less note; all

† Josh. xiv. 2. &c.

‡ 1 Kings iv. 7. &c.

all which lay on this side of the Jordan. The rest, on the other side, were those of Gilead, Peræa, Gaulonitis, Auranitis, Batanea, and Decapolis. Josephus mentions † another division made in Gabinius's time into five districts, or, as he styles them, συνεδρια or *councils*, agreeable to the Roman manner: these were Jerusalem, Jericho, and Sephoris on this side Jordan; and Gadaris and Amathus on the other. In the reigns of the Christian emperors, it was divided afresh into Palestina Prima, Palestina Secunda, and Palestina Tertia or Salutaris; which last included the far greater part, if not the whole country, as is known to all who are acquainted with history. On that account we shall wave all other divisions and changes that happened to it under the northern barbarians, Saracens, &c. and conclude this article with the present state and division of it under the Turks.—The whole country of Palastine is now reduced to a district or province, under the beglerbegate or bassaship of Scham or Damascus, who hath the seven following sangiacs or subgovernors under him, styled, according to the different places of their residence, 1. The sangiac of Damascus, who is under the basha of that province; 2. Of Jerusalem, or, as the Turks call it, *Cudjembaric* or *Coudscherif*; 3. Aglum; 4. Bahara; 5. Scifat; 6. Gaza; 7. Nabolos. Each of these has a number of ziamets, and each ziamet a number of timariots under them; for the better understanding of which terms, we shall refer our readers to Sir Paul Ricaut's account of the Ottoman empire. At present it will be sufficient to say of these inferior subdivisions, under the sangiac of this district, or sangiacate of Jerusalem, that it hath nine of the former and sixteen of the latter class. Neither must the reader imagine these sangiacates or sub-governments to be any thing considerable, or the residence of these officers to be places of any note or opulence. The former indeed live by oppressing the people under them, and extort contributions of every thing that comes within their reach, such as the protection of travellers, merchants, and caravans; but being all under their respective bashas, who are still more griping than their underlings, they are commonly fleeced of some considerable part of their unjust gains. As for the places of their residence, except it be here and there one in a considerable city, as at Damascus and Jerusalem, the rest are either some old cities or even inconsiderable villages.

† *Ant'q* lib xiv.

There are a variety of curiosities in Palestine both natural and artificial; but they are so very numerous as almost to preclude description: we therefore refer our readers to the Ancient Universal History, Vol. II. where they are mentioned and particularly described. The principal mountains, rivers, and other places of note, have already been, or will be, noticed under their respective names.

PALESTRINA, a town of Italy, in the Campagna di Roma, with a bishop's see. It is the capital of a principality of the same name, and the bishop is one of the six cardinal bishops. It was anciently famous for the temple of Fortune, being then called *Præneste*, and seated on the top of a mountain, the ruins of which may yet be seen. E. Long. 12. 55. N. Lat. 41. 51.

PALESTRINA, is one of the largest and most populous of the islands called the Lagunes near Venice, and where the most considerable of the noblemen have houses of pleasure. It is 15,000 paces in length and 400 in breadth; the principal harbour has also the same name.

PALFIN (John), an eminent surgeon, anatomist, and reader in surgery at Ghent, the place of his birth; acquired great reputation by his learning and works. The principal of these are, 1. A Treatise on Osteology, in 12mo, Paris, 1731. 2. Anatomy of the Human Body, in 2 vols. 8vo, Paris, 1734. He died at Ghent at a great age, in 1730.

PALFREY, is one of the better sort of horses used by noblemen or others for state; and sometimes of old taken for a horse fit for a woman to ride. Camden says, that William Fauconberge held the manor of Cukeny, in the county of Nottingham, in serjeantry, by the service of shoeing the king's palfrey when the king should come to Mansfield.

PALICAUD, or PALGATCHERRY, a fortress of considerable strength in India, which commands the passage between the two coasts of Malabar had Coromandel, by way of the Tritchinopoly and Coimbettore countries: there is also a communication with it thro' the Nayre country. It is in the hands of the English; and is of great importance to them, because, as Coimbettore is in the hands of Tippoo, by our holding this place on the west, and Dindigul on the east of Coimbettore, the province is rendered of little use to Tippoo in time of war, unless he keeps a very large force there to protect it. See Memoir of a Map of the Peninsula of India by Major Rennel.

PALICATE, a sea port town of India, on this side of the Ganges. It is is seated on the coast of Coromandel, in the kingdom of Carnate, 70 miles north of Fort St George. Here the Dutch have a factory, and fort called the *Fort of Guelderland.* E. Long. 80. 1. N. Lat. 13. 34.

PALICI, or PALISCI (fab. hist.), two deities, sons of Jupiter by Thalia, whom Æschylus, according to Macrobius, calls *Ætna*, in a tragedy which is lost. The nymph Ætna, when pregnant, begged Jupiter to remove her from the pursuit of Juno. Upon which he concealed her in the bowels of the earth; and when the time of her delivery arrived, the earth opened and brought into the world two children, to whom were given the name of *Palici*, απο του παλιν ικεσθαι, *because they came again into the world from the bowels of the earth.* These deities were worshipped with many ceremonies by the Sicilians; and near their temple were two small lakes, which were supposed to have sprung out of the earth when they were born. Near these pools it was usual to take the most solemn oaths when any body wished to decide controversies and quarrels. If any of the persons who took the oaths were perjured, they were immediately punished supernaturally; and those whose oath, by the deities of the place, was sincere, departed unhurt. The Palici had also an oracle, which was consulted upon some great emergencies, and which rendered the truest and most unequivocal answers. In a superstitious age, the altars of the Palici were stained with the blood of human sacrifices; but this barbarous custom did not last long, as the deities were satisfied with the usual offerings.

PALINDROMUS, a verse or sentence which runs the

the same when read either backwards or forwards. Such is the verse,

*Roma tibi subito motibus ibit amor.*

Some people of leisure have refined upon the Palindromus, and composed verses, each word of which is the same backwards as forwards; for instance, that of Camden:

*Odo tenet mulum, madidam mappam tenet Anna.*
*Anna tenet mappam madidam, mulum tenet Odo.*

PALINGENESIA, among divines, the same with regeneration. Among chemists, it denotes the producing of a body from its principles.

PALINGENIUS (Marcellus), well known by a poem divided into 12 books, and entitled *Zodiacus Vitæ*, which he was several years in composing, and dedicated to Hercules II. of Este, duke of Ferrara. Some say he was physician to that prince: others rank him among the learned Lutherans, to whom the duchess of Ferrara gave a reception in her court, and honoured with her protection. His *Zodiac* contains good things, and is a philosophical satire against immorality and false prejudices. Though this poem has borne a multitude of impressions, the author's life is but little known. He died some time between the years 1537 and 1543.

PALINODY, a discourse contrary to a preceding one: hence the phrase of *palinodiam canere* was taken for a recantation.

PALINURI PROMONTORIUM (Virgil, Velleius), with a cognominal port, was situated at the south extremity of the Sinus Pæstanus on the coast of Lucania: so called from Palinurus, Æneas's steersman, who there perished (Mela, Dionysius Halicarnasseus).

PALINURUS (fab. hist.), Æneas's pilot, whose fate Virgil very particularly describes. He fell into the sea when asleep; and was three days exposed to the tempests and its agitation, and at last came safe ashore, where the cruel inhabitants of the place murdered him to get his clothes. His body was left unburied on the sea shore: and since, according to the religion of the old Romans, no one could cross the Stygian lake before 100 years were elapsed, if his remains had not been decently buried, we find Æneas, when he went down to hell, speaking to Palinurus, and assuring him, that though his bones were deprived of a funeral, yet the place where his body was exposed should soon be adorned with a monument, and bear his name; and accordingly a promontory was called *Palinurus*.

PALISADES, in fortification, stakes made of strong split wood, about nine feet long, six or seven inches square, three feet deep in the ground, in rows about two and a half or three inches asunder, placed in the covert way, at three feet from, and parallel to, the parapet or side of the glacis, to secure it from surprise. They are also used to fortify the avenues of open forts, gorges, half moons, the bottoms of ditches, and in general all posts liable to surprise. They are usually fixed perpendicularly, though some make an angle inclining towards the ground next the enemy, that the ropes cast over them to tear them up may slip off.

*Turning* PALISADES; an invention of M. Cochorn, in order to preserve the palisades of th covert way from the besiegers shot. They are so ordered, that as many of them as stand in the length of a rod, or about ten feet, turn up and down like traps, so as not to be in sight of the enemy till they just bring on their attack; and yet are always ready to do the proper service of palisades.



PALISSE, in heraldry, a bearing like a range of palisades before a fortification, represented on a fesse, rising up a considerable height, and pointed a-top, with the field appearing between them.

PALIURUS, in botany. See RHAMNUS.

PALL, in heraldry, a figure like a Greek Υ, about the breadth of a pallet; it is by some heralds called a *cross pall*, on account of its being looked upon as an archiepiscopal bearing.

PALLA, in Roman antiquity, a mantle which women wore over the gown called *stola*. It was borne on the left shoulder; whence passing to the other side, under the right arm, the two ends were bound under the left arm, leaving the breast and arm quite bare. It had a great many folds, and derived its name from παλλω, to *shake* or *tremble*.

PALLADIO (Andrea), a celebrated Italian architect of the 16th century, was a native of Vicenza in Lombardy, and the disciple of Trissin. He made exact drawings of the principal works of antiquity to be met with at Rome, adding commentaries to them, which went through several impressions. But this, though a very useful work, was greatly exceeded by the Treatise of Architecture in four books, which he published in 1570. Inigo Jones wrote some excellent remarks on it; which were included in an edition of Palladio, published by Leoni, in two vols. folio, 1742.

PALLADIUM, in antiquity, a statue of the goddess Pallas. It was about three cubits high, and represented the goddess sitting and holding a pike in her right hand, and in her left a distaff and a spindle. It fell down from heaven near the tent of Ilus, as he was building the citadel of Ilium. Some, however, suppose, that it fell at Pessinus in Phrygia; or, according to others, Dardanus got it as a present from his mother Electra. There are some who maintain, that the palladium was made with the bones of Pelops by Abaris; but Apollodorus says, that it was no more than a piece of clock work which moved of itself. However various the opinions of ancient authors be about this celebrated statue, it is universally allowed, that on its preservation depended the safety of Troy. This fatality the Greeks, during the Trojan war, were well aware of; and therefore Ulysses and Diomedes were commissioned to steal it. This they effected; and if we can rely upon the authority of some, they were directed how to carry it away by Helenus a son of Priam, who in this betrayed his country, because his brother Deiphobus, at the death of Paris, had married Helen, of whom he was enamoured. Minerva was enraged at the violence offered to her statue; and, according to Virgil, the palladium itself seemed to have received life and motion; and by the flashes which started from its eyes, and sudden springs from the earth, it seemed to show the resentment of the goddess. The true palladium, as is observed by some, was not carried away from Troy by the Greeks, but only

only a statue of similar size and shape, which was placed near it, to deceive whatever sacrilegious persons attempted to steal it. The palladium, therefore, as they maintain, Æneas conveyed safe from Troy to Italy, and it was afterwards preserved by the Romans with the greatest secrecy and veneration in the temple of Vesta; a circumstance which none but the vestal virgins knew. It was esteemed the destiny of Rome; and there were several others made perfectly like to it, to secure it from being stolen, as was that at Troy, which the oracle of Apollo declared should never be taken so long as the palladium was found within its walls. A palladium was also placed by Nicias in the citadel of Athens.

PALLADIUS, bishop of Helenopolis in Bithynia, and then of Aspona. He was a Galatian, and born at Cappadocia He became an anchorite in the mountain of Nebria in 388, and was consecrated a bishop in 401. He was an intimate friend of St John Chrysostom, whom he never forsook during the time of his persecution, nor even in his exile. He went to Rome some time after Chrysostom's death, and at the request of Lausus governor of Cappadocia, composed the History of the Anchorites or Hermits, and entitled it *Lausiaca*, after the name of that lord, to whom he dedicated it in 420, when it was written, being then the 20th year of his episcopacy, and 53d of his age. Palladius was accused of being an Origenist. It is true, he was an enemy to St Jerome, of whom he does not speak well, and was intimately connected with Ruffinus; but perhaps no good proof can be brought of his Origenism. He had been the disciple of Evagrias of Pontus, and was even suspected of entertaining the sentiments of Pelagius. He died in the 5th century, but in what year is not certain. His History was published in Greek by Meursius at Amsterdam in 1619, and in Latin in the *Bibliotheca Patrum*: but he seems not to have been the writer of the Life of St John Chrysostom, in Greek and Latin by M. Bigot, printed in 1680.

PALLAS, a freed man of Claudius, celebrated for the power and the riches which he obtained. He advised the emperor his master to marry Agrippina, and to adopt her son Nero for his successor. It was through him and Agrippina that the death of Claudius was hastened, and that Nero was raised to the throne. Nero, however, forgot to whom he was indebted for it. He discarded Pallas, and some time after caused him to be put to death, that he might procure his great riches.

PALLAVICINI (Ferrante), an Italian wit of considerable note, was descended from a branch of a noble family seated in Placentia, where he was born about the close of the 16th century. He soon gave great proofs of an extraordinary genius, and quickly acquired a masterly knowledge in the elements of classical erudition. He was afterwards sent to complete his education in the monastery of Augustin friars at Milan, where he took the habit, lived much esteemed, improved himself in piety as well as learning, and raised great expectations of future fame; but being somewhat amorously inclined, he engaged in an intrigue with a young courtezan of Venice, whose charms proved irresistible; and in order to enjoy them without restraint, he obtained leave from his general to make the tour of France. Accordingly, he pretended to set out for that country; but it was only a blind to cover his real design. He never left Venice, but lived there privately, enchanted in the arms of his Venus: and having too ready a talent at invention, he imposed upon his friends by often sending them in letters feigned accounts of his travels through France; also informing them of several things respecting that court, which he learned from the advices of many considerable persons with whom he corresponded.



His money in the mean time flew with expanded wings, and he soon found his purse much drained. In this exigence he naturally had recourse to his wits for supplies. He wrote for the booksellers; and composed several pieces, more for the sake of lucre than out of fondness for authorship. Among other things, he wrote a collection of letters, mostly satirical, which he called *The Courier Robbed of his Mail*. The work appeared at first in such a cast, as could not give great offence except to the Spaniards, against whom he had some grudge. The piece was accordingly licensed by the inquisitors; but falling into the hands of the secretary of the republic of Venice, who at that time was licenser of books, he would not give his imprimatur, though great interest was employed for that purpose, neither would he return the manuscript. This enraged Pallavicini so much, that had not his friends restrained him, he would have pursued the affair to his ruin.

At length he found an opportunity of travelling into Germany with the duke of Amalfi as his chaplain. This journey, as was to be expected, had no good effect either upon his wit or his morals. On the contrary, finding himself, from the manners of the Germans, more at liberty, he indulged his genius and passions with greater ease; and after a residence there of upwards of a year with the duke, he returned to Venice, with a face marked all over with blotches like the evil, and a spirit resolved to sacrifice to his resentment at the risk of his life. He was resolved to have his full measure of revenge against the secretary of the republic for keeping his manuscript; and with him his resentment joined the family of Barberini, Pope Urban VIII. and his nephews, because they also endeavoured, at the instigation of the Jesuits, to get all his manuscripts forbid the press. In this rancorous spirit he cast his Courier into a new model, and enlarged it with many letters and discourses. Thus new modelled, he offered it to a bookseller, who undertook to get it printed; but our author was betrayed by a pretended friend; who acted the part of a spy, and informed the archbishop of Vitelli, then the pope's nuncio at Venice, just as the work was finished at the press: at the same time, this treacherous friend bought the whole impression; and upon the nuncio's complaint, Pallavicini was imprisoned. In this miserable condition he found a friend in one of his mistresses, who, seeing him abandoned by most of his patrons, not only supported him, but conveyed letters to him, by which she gave him such information as enabled him to make a proper defence, and to recover his liberty.

But a war having in the mean time broke out between the Barberini and the duke of Parma; Pallavicini,

vicini, in order to revenge himself upon the supposed instruments of his imprisonment, wrote a piece entitled "The tinkling Instrument to call together the Barberini Bees;" and dedicated it in terms of the profoundest contempt to the nuncio Vitelli. The nuncio finding that little notice was taken of his complaints on the occasion, procured by bribery one Charles Morfu, a Frenchman of infamous character, who pretended to pass for a gentleman, to ensnare Pallavicini: to which end, the traitor used his best endeavours to insinuate himself into his friendship, and at length exhorted him to accompany him to France. He declared that his fortune would be made by the extraordinary encouragement which was given to men of letters by Cardinal Richelieu; and the better to favour the deceit, he produced feigned letters from the Cardinal, inviting our author to France, and expressing a desire he had to establish in Paris an academy for the Italian tongue, under the direction of Pallavicini. The snare took; and now, fascinated by the prospect of gain, Pallavicini suffered himself to be led like an ox to the slaughter, whithersoever Morfu thought proper. He left Venice much against the advice of his friends, and went first to Bergamo, where he spent a few days with some of his relations, by way of giving some entertainment to Morfu. They then set off for Geneva, to the great satisfaction of our author, who proposed to get some of his works printed there, which he had not been able to do in Italy. Morfu, however, instead of conducting him to Paris, took the road to Avignon; where, crossing the bridge of Soraces, in the county of Venaissin, they were seized by a gang of *sbirri*, or sheriff's officers, on pretence of carrying contraband goods, and confined. Morfu was quickly discharged, and very liberally rewarded; but Pallavicini, being carried to Avignon, was imprisoned; and notwithstanding, on his examination concerning some papers found upon him, he made a very artful defence, it was in vain. The sentence was already brought from Rome, and he was to undergo a trial merely for form's sake. For this purpose being put into a dark dungeon, he made another effort to escape. He managed matters so well with his keeper, as to procure wax candles to be allowed him, under pretence of amusing himself with reading; and when he had got a number of these, he set fire one night to the prison door, in order to get off by that means; but the stratagem did not succeed, and he was of course confined much closer, and treated with great inhumanity. After a year's suffering, he was brought to trial, in which he made an excellent defence, and flattered himself with hopes of relief. He had even begun a whimsical piece on the subject of melancholy; but, contrary to his expectations, he was sentenced to die, and lost his head on a scaffold in the flower of his age.

He was of so heedless and profuse a disposition, that had he possessed an immense estate he would have spent it all. He was never engaged in a virtuous passion, being inflamed to a prodigious and unnatural degree with the love of the meanest and most infamous prostitutes. On the other hand, no one could be more sincere and faithful in his friendships, nor was ever a man a greater prey to treachery; insomuch, that when released from prison in Venice, he was told that a wretch had betrayed him, he could not be prevailed upon to believe it, saying, "How can this be, since he declared himself my friend, and I made him privy to all my concerns!" He used, while he wore a religious habit, to study or write two or three hours in bed every morning. The rest of the day he spent either in the company of idle persons, or else with the ladies: but after he had wholly left the monastic life, upon pretence of securing himself from the snares of his enemies, he lived in a very irregular manner. He was possessed of a fine genius, and had a great facility in writing; and till he was corrupted by the commerce of mean lewd women, he wrote pieces worthy of immortality. He did not spend much time or pains either in composition or in revision, for he frequently sent to the press the very first exertions of his genius; yet nature had given him so noble a vein of eloquence, which he had greatly improved by perusing the best authors, that his first thoughts were often equal to the most laboured compositions. He was modest, and spoke of himself with diffidence; but his works are strongly tinctured with envy, malice, and gall. He made but a poor figure in conversation; and when with persons of worth and distinction, would often retire to a corner of the room, and seem quite wrapt up in thought. He never exerted his wit and humour after his return from Germany, but when he was in the company of some mean women. Upon the whole, it is difficult to determine whether vice or virtue was the most predominant feature in his character. His death gave birth to a dialogue, entitled, *Anima erranti di Ferrante Pallavicini*, or, "The wandering Ghost of Pallavicini." Besides his life at the head of his works in two volumes, there is another prefixed to the "Divortio celeste," at Amsterdam in 1696.



PALLENE, a small peninsula of Thrace or Macedonia, formerly called *Phlegra*. It is situated near the bay of Thermæ, and contains five cities, the principal of which is called *Pallene*. It was famous, according to some of the ancients, for an engagement between the gods and the giants.

PALLET, among painters, a little oval table, or piece of wood, or ivory, very thin and smooth; on and round which the painters place the several colours they have occasion for, to be ready for the pencil. The middle serves to mix the colours on, and to make the tints required in the work. It has no handle, but, instead thereof, a hole at one end to put the thumb through to hold it.

PALLET, among potters, crucible makers, &c. a wooden instrument, almost the only one they use, for forming, beating, and rounding their works. They have several kinds: the largest are oval, with a handle; others are round, or hollowed triangularly; others, in fine, are in manner of large knives, serving to cut off whatever is superfluous on the moulds of their work.

PALLET, in gilding, an instrument made of a squirrel's tail, to take up the gold leaves from the pillow, and to apply and extend them on the matter to be gilt. See GILDING.

PALLET, in heraldry, is nothing but a small pale, consisting of one half of it in breadth, and therefore there are sometimes several of them upon one shield.

PALLET, is also a part belonging to the balance of a watch or movement. See the article WATCH.

PALLIATÆ, a name which the Romans gave to such plays as laid the plot in Greece, and required the

performers to appear in Grecian habits. It is used in contradistinction to *togatæ*, in which the scene was laid at Rome, and in which the dresses were Roman. The word palliatæ is derived from *pallium*, which was a part of dress peculiar to the Greeks; whereas the toga belonged to the Romans only. See TOGATÆ, COMEDY, &c.

PALLIATION, or a PALLIATIVE *Cure*, in medicine, is when, in desperate and incurable diseases, after predicting the fatal event, the physician prescribes some remedies for mitigating the pain or some other urgent symptoms, as in ulcerated cancers, or cancerous fistulas, and the like.

PALLIO *Cooperire*. It was an ancient custom, where children were born out of lawful wedlock, and their parents were afterwards married, that those children, together with the father and mother, should stand *pallio cooperti*, under a cloth, while the marriage was solemnizing; which was a kind of adoption, and had the effect of a legitimation. Thus Robert Grosthead, the famous bishop of Lincoln, in one of his letters, says: *In signum legitimationis, nati ante matrimonium consueverunt poni sub* pallio *super parentes eorum extento, in matrimonii solemnizatione.*

Selden, in his notes on Fleta, adds, that the children of John of Gaunt, duke of Lancaster, by Catharine Swinford, though legitimated by act of parliament, yet were *covered with the pall* when their parents were married.

PALLIUM, a word often mentioned in our old historians. Durandus tells us, that it is a garment made of white wool, after the following manner, viz. The nuns of St Agnes, every year, on the feast day of their saint, offer two white lambs on the altar of their church, during the time they sing *Agnus Dei*, in a solemn mass; which lambs are afterwards taken by two of the canons of the Lateran church, and by them given to the pope's subdeacons, who send them to pasture till shearing time, and then they are shorn, and the pall is made of their wool mixed with other white wool. The pall being thus made, is carried to the Lateran church, and there placed on the high altar, by the deacons of that church, on the bodies of St Peter and St Paul; and after an usual watching, it is carried away in the night, and delivered to the subdeacons, who lay it up safe. And because it was taken from the body of St Peter, it signifies the plenitude of ecclesiastical power: and therefore it was the prerogative of popes, who pretend to be the immediate successors of that saint, to invest other prelates with it; which at first was done nowhere but at Rome, though afterwards at other places.

PALLIUM, in antiquity, an upper garment or mantle worn by the Greeks, as the toga was by the Romans. Each of these was so peculiar to the respective nations, that *Palliatus* is used to signify a Greek, and *Togatus* a Roman.

PALM, has among almost all nations been regarded as an emblem of victory, and assigned as the reward of it. The reason why this tree was adopted, and made use of to represent victory, is said to be, because it is so elastic, that if pressed by the greatest weight, it will rise superior to the pressure, and be able to restore itself to its former state, appearing almost invincible.

*PALM-Sunday*, in the Christian church, the Sunday





next before Easter; being so called in memory of our Saviour's triumphal entry into Jerusalem, when the multitude that attended him strewed branches on his way.

The ancients had other names for this day. For, 1. They called it *Dominica Competentium*, i. e. Sunday of the Competentes; because on that day the catechumens came to ask the bishop leave to be admitted to baptism, which was conferred the Sunday following. They had also then given them the symbol or credo, to get off by heart, to be repeated to the bishop in the ceremony of baptism. 2. They called it *Capitiluvium*, the Sunday of washing the head; because those who were to be baptized the following Sunday, were prepared by washing their heads on this day. Some time afterwards they called it *Indulgence Sunday*, because the emperors and patriarchs used to distribute gifts on that day.

*PALM-Tree*, in botany. See PHOENIX.

PALMA, or *PALMA Nova*, a very strong town of Italy, in the territory of Venice, and in Friuli. It is a very important place, for the defence of the Venetians against the Austrian and Turks; and was built in 1593, for that very purpose. They have cut a canal near this place, which is very advantageous. It is seated on the sea side, 10 miles south-east of Udino, and 55 north-east of Venice. E. Long. 13. 15. N. Lat. 46. 2.

PALMA, an island in the Atlantic ocean, and one of the Canaries, 56 miles north-west of Gomera, and about 75 in circumference. It abounds in wine and sugar; and has a handsome town of the same name, which carries on a trade in wine to the West Indies and other parts. Their best vines grow in a soil called the *Brenia*, where they make 12,000 butts of wine every year, which is well known by the name of *palm wine*. There is plenty of cattle, and all sorts of fruits. In 1625 a volcano broke out in this island, with a most violent earthquake; the flame was seen for six weeks together, and a great quantity of ashes were thrown as far as Teneriff. It was conquered by the Spaniards in 1460.

PALMÆ, *Palms*. Under this name Linnæus has arranged several genera, which, although capable of a place in separate classes of his system, he chooses rather, on account of their singular structure, to place apart, in an appendix to the work.—See ARECA, CHAMÆROPS, PHOENIX, COCOS, &c.; and CORYPHA.

The same plants constitute one of the seven families or tribes into which all vegetables are distributed by Linnæus in his *Philosophia Botanica*. They are defined to be plants with simple stems, which at their summit bear leaves resembling those of the ferns, being a composition of a leaf and a branch; and whose flowers and fruit are produced on that particular receptacle or seat called a *spadix*, protruded from a common calyx in form of a sheath or scabbard, termed by Linnæus *spatha*.

*Palmæ* is likewise the name of the first order in Linnæus's Fragments of a Natural Method. See BOTANY, p. 457.

PALMARIS MUSCLE, in anatomy. See there, *Table of the Muscles*.

PALMATED, something resembling the shape of the hand: thus we say, palmated leaves, roots, stones, &c.

PALMERSTON's Island, situated in the South Seas, which Captain Cook visited in his second and last voyages. It consists of a group of small islets, nine or ten in number, connected by a reef of coral rocks, and lying in a circular direction. It admits of no anchorage, nor are there any inhabitants on it, though it abounds with cocoa nuts, scurvy grass, and the wharra tree. This island is not more than a mile in circumference, and is not elevated above three feet above the level of the sea. It consists entirely of a coral sand, with a small mixture of blackish mould, which appeared to be produced from rotten vegetables. "At one part of the reef (say our navigators), which bounds the lake within, almost even with the surface, there was a large bed of coral, which afforded a most enchanting prospect. Its base, which was fixed to the shore, extended so far that it could not be seen, so that it appeared to be suspended in the water. Even this delightful scene was greatly improved by the multitude of fishes that gently glided along, seemingly with the most perfect security. Their colours were the most beautiful that can be imagined, blue, yellow, black, red, &c. far excelling any thing that can be produced by art. The richness of this submarine grotto was greatly increased by their various forms; and the whole could not possibly be surveyed without a pleasing transport, accompanied at the same time with regret, that a work so astonishingly elegant should be concealed in a place so seldom explored by the human eye." E. Long. 196. 35. S. Lat. 18. 8.

PALMIPEDES, among ornithologists, the same with web-footed birds. See Ornithology.

PALMISTRY, a kind of divination, or rather a deceitful art practised by gypsies, who pretend to foretel events by looking upon the lines and marks of the hand.

PALMUS, a long measure used both by the Greeks and Romans. The Grecian palmus was of two sorts; the greater, which contained nine finger breadths, and the less which contained four. The Roman palmus was also of two sorts; the greater, which contained twelve finger breadths, or eight inches and a half English; and the less, which contained four finger breadths, or near three inches English.—The great palmus was taken from the length of the hand or span; the less from the breadth of it. The Greek palmus was called *doron*. See Measure.

PALMYRA, or Tadmor, a noble city of ancient Syria, now in ruins, the origin of whose name is uncertain. Neither is it well known by whom this city was built; for though, from the identity of the names, it is thought by many to have been the *Tadmor in the wilderness* built by Solomon †, this point, however, is much controverted by many learned men. For the world have been long and justly astonished to find in the desert of Syria, at a distance from the sea, with a very precarious and scanty supply of water only, and without a particular connexion with any great monarchy, ruins of a city more extensive and splendid than Rome itself, the depositary of all the arts which Greece in its most flourishing periods could afford. The problem is an intricate one; yet when we divest it of many of its difficulties, we shall bring this stupendous prodigy to no very uncommon magnitude. The coast of Syria was in very early ages rich and populous; and either from the conveniency of procuring water, or from the vicinity of India and Egypt, the population, instead of increasing on the mountains, extended to Judea, and from thence through its plains only to the internal parts. The ruins of this numerous people, and of their habitations, remain; but as their edifices were not uncommonly splendid, or, as the causes of their destruction were powerful, they have not attracted much attention. Yet the ruins of more than 30 towns are discoverable to the south-east of the Dead Sea, and from thence towards Tadmor or Palmyra; we know the cause of the destruction of these towns, and we know that it did not reach Palmyra. This splendid city was not, therefore, insulated in a mass of sand: it was probably a link of a continued chain of population, or perhaps its termination. The situations of towns in the Sandy Desert must necessarily be determined by local advantages. Tadmor is situated where two hills converge, and beyond the point where they approach. These hills afforded water, that necessary aid to animal life; and the aqueducts through which it was brought from them were discovered and described by Mr Wood. Though the other towns now in ruins afford some remains of luxury and opulence, yet in these respects they are much inferior to Palmyra; and this deserves to be explained. Palmyra was undoubtedly very ancient. "The two springs of fresh water it possesses (says Volney †) were, above all, a powerful inducement in a desert everywhere else so parched and barren. These, doubtless, were the two principal motives which drew the attention of Solomon, and induced that commercial prince to carry his arms so remote from the limits of Judea." "He built strong walls there (says the historian Josephus), to secure himself in the possession, and named it *Tadmor*, which signifies the Place of Palm trees." Hence it has been inferred that Solomon was its first founder; but we should, from this passage, be rather led to conclude that it was already a place of known importance. The palm trees he found there are not the trees of uninhabited countries. Prior to the days of Moses, the journeys of Abraham and Jacob from Mesopotamia into Syria, sufficiently prove a communication between these countries, which must soon have made Palmyra flourish. The cinnamon and pearls mentioned in the time of the Hebrew legislator, demonstrate a trade with India and the Persian gulf, which must have been carried on by the Euphrates and Palmyra. At this distance of time, when the greater part of the monuments of these early ages have perished, we are liable to form very false opinions concerning the state of these countries in those remote times, and are the more easily deceived, as we admit as historical facts antecedent events of an entirely different character. If we observe, however, that men in all ages are united by the same interests and the same desires, we cannot help concluding, that a commercial intercourse must early have taken place between one nation and another, and that this intercourse must have been nearly the same with that of more modern times. Without, therefore, going higher than the reign of Solomon, the invasion of Tadmor by that prince is sufficient alone to throw a great light on the history of this city. The king of Jerusalem would never have carried his attention to so distant and detached

† 1 Kings, ix. 18. and 2 Chron. viii. 4. and Josephus, Ant. Jud. Lib. I.

† *Travels through Syria and Egypt.*

Palmyra. tached a spot, without some powerful motive of interest; and this interest could be no other than that of an extensive commerce, of which this place was already the emporium. This commerce extended itself to India; and the Persian gulf was the principal point of union."

From the nature of the commodities, from the requisite assistance of the Tyrians, and other forcible arguments, M. Volney shows that the Persian gulf was the centre of the most ancient commerce of the eastern world; and that it was with a view of obtaining a shorter route, by means of the Euphrates, that Solomon turned his attention to Tadmor, distant but three days journey from it. Our author goes on, "We may even reasonably conjecture, when we reflect on the revolutions of the following ages, that this commerce became a principal cause of those various wars in Lower Asia, for which the barren chronicles of those early times assign no motives. If, after the reign of Solomon, the Assyrians of Nineveh turned their ambitious views towards Chaldea, and the lower part of the Euphrates, it was with the intention to approach that great source of opulence the Persian gulf. If Babylon, from being the vassal of Nineveh, in a short time became her rival, and the seat of a new empire, it was because her situation rendered her the emporium of this lucrative trade; in short, if the kings of this great city waged perpetual wars with Jerusalem and Tyre, their object was not only to despoil these cities of their riches, but to prevent their invading their trade by the way of the Red sea. An historian who has informed us that Nabuchodonosor, before he laid siege to Jerusalem, took possession of Tadmor, clearly indicates that the latter city acted in concert with the two neighbouring capitals. Their gradual decline became, under the Persian empire, and the successors of Alexander, the efficient cause of the sudden greatness of Palmyra in the time of the Parthians and Romans; she then enjoyed a long peace for many centuries, which allowed her inhabitants to erect those monuments of opulence whose ruins we still admire." If the former observations showed the connexion of this remote spot with a more populous country, these remarks explain the cause of the renovation, and of the magnificence of this city. Our author's remarks are at least probable, and are, in our opinion, very convincing. Cairo, in another, probably a subordinate route, never attained the splendour of Palmyra; but the genius of the Egyptians, perhaps the laws of Egypt, prevented it.

There is, however, no authentic history of Palmyra till after the captivity of the Roman emperor Valerian by the Persians. It is first mentioned by the Roman historians, as a place which Mark Antony attempted to plunder, upon pretence that it had not observed a just neutrality between the Romans and Parthians. Pliny takes notice of it as being situated in a rich soil, among pleasant streams, and totally separated from the rest of the world by a vast sandy desert, which had preserved its independence between Parthia and Rome. There is still a considerable spot of good soil next the town and on the hills; and even in the wilderness, there were palms and fig trees, some of which remained till the latter end of the 17th century, though not one is now to be found.

After the captivity of Valerian, it was become an opulent city, to which its situation in the vinicity of the Roman and Parthian empires greatly contributed; as the caravans, in going to or returning from the east, frequented the place, and thus rendered it a considerable seat of merchandise. It enjoyed an independency till the time of Trajan; who, having made himself master of almost all the Parthian empire, reduced Palmyra likewise, and it was afterwards accounted part of the Roman dominions. But when the defeat and captivity of Valerian had so much weakened the empire, that the Persians seemed to be in a fair way of becoming masters of all the eastern provinces, the Palmyrenians began to entertain thoughts of recovering their liberty. Odenathus, prince of Palmyra, sent a very respectable letter to Sapor on his return, accompanied with considerable presents; but by that haughty conqueror his letter and embassy were treated with the most provoking contempt. The presents were thrown into the Euphrates: and to his letter Sapor replied, That his insolence in presuming to write to his lord was inexcusable; but if he could atone for it in any way, it would be by presenting himself before the the throne bound hand and foot, in token of a consciousness of his crime, and the punishment he deserved. With this injurious treatment Odenathus, was so provoked, that he swore either to bring down the pride of the haughty conqueror, or die in the attempt. Accordingly, having assembled what forces he could, he fell upon the Persians, destroyed a number of them, took a great part of their baggage, and some of the king's concubines. Of the war of Odenathus with the Persians, however, we know very little: only that though the latter were often vanquished and the independency of Palmyra established for the present; yet Valerian was never released from his captivity, though Odenathus earnestly wished to have the honour of rescuing him from his enemies.

Odenathus enjoyed his sovereignty but a very short time: being murdered by his nephew, who was soon after put to death by Zenobia the wife of Odenathus. This lady is said to have been possessed of very extraordinary endowments both of body and mind, being, according to Mr Gibbon, almost the only Asiatic woman who is recorded to have overcome the obstacles arising from the confined situation of the fair sex in that part of the world. Immediately on taking vengeance for the murder of her husband, she assumed the government, and soon strengthened herself so much, that she resolved to submit neither to the Roman nor Persian power. The neighbouring states of Arabia, Armenia, and Persia, dreaded her enmity, and solicited her alliance. To the dominions of Odenathus, which extended from the Euphrates to the frontiers of Bithynia, his widow added the inheritance of her ancestors, the populous and fertile kingdom of Egypt. The emperor Claudius acknowledged her merit, and was content, that, while he pursued the Gothic war, she should assert the dignity of the empire in the east. The conduct, however, of Zenobia, was attended with some ambiguity; nor is it unlikely that she had conceived the design of erecting an independent and hostile monarchy. She blended with the popular manners of Roman princes the stately pomp of the courts of Asia, and exacted from her subjects the same adoration that was

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was paid to the successors of Cyrus. She bestowed on her three sons a Latin education, and often showed them to the troops adorned with the imperial purple. For herself she reserved the diadem, with the splendid but doubtful title of *Queen of the East*.

When Aurelian passed over into Asia, against an adversary whose sex alone could render her an object of contempt, his presence restored obedience to the province of Bithynia, already shaken by the arms and intrigues of Zenobia. Advancing at the head of his legions, he accepted the submission of Ancyra; and was admitted into Tyana, after an obstinate siege, by the help of a perfidious citizen. The generous, though fierce temper of Aurelian, abandoned the traitor to the rage of the soldiers: a superstitious reverence induced him to treat with lenity the countrymen of Apollonius the philosopher. Antioch was deserted on his approach; till the emperor, by his salutary edicts, recalled the fugitives, and granted a general pardon to all who, from necessity rather than choice, had been engaged in the service of the Palmyrenian queen. The unexpected mildness of such a conduct reconciled the minds of the Syrians, and, as far as the gates of Emesa, the wishes of the people seconded the terror of his arms.

Zenobia would have ill deserved her reputation, had she indolently permitted the emperor of the West to approach within 100 miles of her capital. The fate of the East was decided in two great battles; so similar in almost every circumstance, that we can scarcely distinguish them from each other, except by observing that the first was fought near Antioch, and the second near Emesa. In both, the queen of Palmyra animated the armies by her presence, and devolved the execution of her orders on Zabdas, who had already signalized his military talents by the conquest of Egypt. The numerous forces of Zenobia consisted for the most part of light archers, and of heavy cavalry clothed in complete steel. The Moorish and Illyrian horse of Aurelian were unable to sustain the ponderous charge of their antagonists. They fled in real or affected disorder, engaged the Palmyrenians in a laborious pursuit, harassed them by a desultory combat, and at length discomfited this impenetrable but unwieldy body of cavalry. The light infantry, in the mean time, when they had exhausted their quivers, remaining without protection against a closer onset, exposed their naked sides to the swords of the legions. Aurelian had chosen these veteran troops, who were usually stationed on the Upper Danube, and whose valour had been severely tried in the Allemannic war. After the defeat at Emesa, Zenobia found it impossible to collect a third army. As far as the frontier of Egypt, the nations subject to her empire had joined the standard of the conqueror; who detached Probus, the bravest of his generals, to possess himself of the Egyptian provinces. Palmyra was the last resource of the widow of Odenathus. She retired within the walls of her capital; made every preparation for a vigorous resistance; and declared with the intrepidity of a heroine, that the last moment of her reign and of her life should be the same.

In his march over the sandy desert, between Emesa and Palmyra, the emperor Aurelian was perpetually harassed by the Arabs; nor could he always defend his army, and especially his baggage, from those flying troops of active and daring robbers, who watched the moment of surprise, and derided the slow pursuit of the legions. The siege of Palmyra was an object far more difficult and important; and the emperor, who with incessant vigour pressed the attacks in person, was himself wounded with a dart. "The Roman people, (says Aurelian, in an original letter), speak with contempt of the war which I am waging against a woman. They are ignorant both of the character and of the power of Zenobia. It is impossible to enumerate her warlike preparations, of stones, of arrows, and of every species of missile weapons. Every part of the walls is provided with two or three balistæ, and artificial fires are thrown from her military engines. The fear of punishment has armed her with a desperate courage. Yet I trust still in the protecting deities of Rome, who have hitherto been favourable to all my undertakings." Doubtful, however, of the protection of the gods, and of the event of the siege, Aurelian judged it more prudent to offer terms of an advantageous capitulation: to the queen, a splendid retreat; to the citizens, their ancient privileges. His proposals were obstinately rejected, and the refusal was accompanied with insult.

The firmness of Zenobia was supported by the hope, that in a very short time famine would compel the Roman army to repass the desert; and by the reasonable expectation that the kings of the East, and particularly the Persian monarch, would arm in the defence of their most natural ally. But fortune, and the perseverance of Aurelian, overcame every obstacle. The death of Sapor, which happened about this time, distracted the councils of Persia; and the inconsiderable succours that attempted to relieve Palmyra were easily intercepted either by the arms or the liberality of the emperor. From every part of Syria a regular succession of convoys safely arrived in the camp, which was increased by the return of Probus with his victorious troops from the conquest of Egypt. It was then that Zenobia resolved to fly. She mounted the fleetest of her dromedaries; and had already reached the banks of the Euphrates, about 60 miles from Palmyra, when she was overtaken by the pursuit of Aurelian's light-horse, seized, and brought back a captive to the feet of the emperor. Her capital soon after surrendered, and was treated with unexpected lenity. The arms, horses, and camels, with an immense treasure of gold, silver, silk, and precious stones, were all delivered to the conqueror; who, leaving only a garrison of 600 archers, returned to Emesa, and employed some time in the distribution of rewards and punishments at the end of so memorable a war, which restored to the obedience of Rome those provinces that had renounced their allegiance since the captivity of Valerian.

When the Syrian queen was brought into the presence of Aurelian, he sternly asked her, How she had presumed to rise in arms against the emperors of Rome? The answer of Zenobia was a prudent mixture of respect and firmness: "Because I disdained to consider as Roman emperors an Aureolus or a Gallienus. You alone I acknowledge as my conqueror and my sovereign." But as female fortitude is commonly artificial, so it is seldom steady or consistent. The courage of Zenobia deserted her in the hour of trial: she trembled at the angry clamours of the soldiers, who called aloud

Palmyra.

aloud for her immediate execution; forgot the generous despair of Cleopatra, which she had proposed as her model; and ignominiously purchased life by the sacrifice of her fame and her friends. It was to their councils, which governed the weakness of her sex, that she imputed the guilt of her obstinate resistance; it was on their heads that she directed the vengeance of the cruel Aurelian. The fame of Longinus, who was included among the numerous and perhaps innocent victims of her fear, will survive that of the queen who betrayed, or the tyrant who condemned him. Genius and learning were incapable of moving a fierce unlettered soldier, but they had served to elevate and harmonize the soul of Longinus. Without uttering a complaint, he calmly followed the executioner, pitying his unhappy mistress, and bestowing comfort on his afflicted friends.

Returning from the conquest of the East, Aurelian had already crossed the straits which divide Europe from Asia, when he was provoked by the intelligence that the Palmyrenians had massacred the governor and garrison which he had left among them, and again erected the standard of revolt. Without a moment's deliberation, he once more turned his face towards Syria. Antioch was alarmed by his rapid approach, and the helpless city of Palmyra felt the irresistible weight of his resentment. We have a letter of Aurelian himself, in which he acknowledges, that old men, women, children, and peasants, had been involved in that dreadful execution, which should have been confined to armed rebellion: and although his principal concern seems directed to the re-establishment of a temple of the sun, he discovers some pity for the remnant of the Palmyrenians, to whom he grants the permission of rebuilding and inhabiting their city. But it is easier to destroy than to restore. The seat of commerce, of arts, and of Zenobia, gradually sunk into an obscure town, a trifling fortress, and at length a miserable village.

Little is known concerning the fortunes of Palmyra since the time of Mahomet, except that it was considered as a place of strength; and that in the 12th century there were 2000 Jews in it. With respect to the ruins, they appeared to be of two different and distinct periods; the oldest are so far decayed as not to admit of mensuration, and look as if they had been reduced to that state by the hand of time; the others appear to have been broken into fragments by violence. Of the inscriptions none are earlier than the birth of Christ, and none are later than the destruction of the city by Aurelian, except one, which mentions Dioclesian.

Mr Wood is of opinion, that the face of the country which surrounds Palmyra was always the same; but though Palmyra was always said to be situated in a wilderness, it does not follow that the wilderness was always of the same extent: it is perhaps more probable, that when Palmyra was first settled, the rich soil mentioned by Pliny extended much farther; for whatever were the reasons for making a settlement there, Palmyra can scarcely be supposed to have invited a greater number of people than it could feed. The palms and fig trees that were formerly found on the hills, and in the borders of the desert, that are now totally barren, confirm this opinion. Mr Wood observes, that while he was there a whirlwind happened, which took up such quantities of sand as quite darkened the sky; this sand therefore might by degrees encroach upon the fertile environs of Palmyra, and reduce the number of inhabitants as it reduced their sustenance, till the few wretched families only were left, who found it difficult to furnish food for Mr Wood and his company, though they did not continue longer than a fortnight among them. It will also appear from history, that what is supposed to have happened here has happened at other places, where such an event was much less probable. § On the sea coast in the neighbourhood of St Pol de Leon, in Lower Bretagne, there is a considerable tract of land which before the year 1666 was inhabited, but which was rendered uninhabitable by a sand, which encroaching every year, covered it to the depth of above 20 feet. In the year 1718 it had advanced more than six leagues, and within one league of St Pol; so that it was then thought probable that the town would of necessity be abandoned. This sand is raised by the east or north-east wind, which drives it in clouds with great swiftness, and in a prodigious quantity. It was also attested by the captain of a ship, and all on board, that in the year 1719 there fell in the Atlantic ocean, at 15 degrees of north latitude, and at the distance of more than eight leagues from any land, a shower of sand, some of which they produced, and deposited in the academy at Paris †.

§ *Memoirs of French Academy, for 1718.*

† *Hist. of the Acad. 1772.*

The company with whom Mr Wood, the publisher of the Ruins of Palmyra, travelled, arrived at length at the end of the plain, where a ridge of barren hills, by which it was divided on the right and left, seemed to meet; between them there was a vale, through which an aqueduct formerly conveyed water to Palmyra. On each side of this vale they remarked several sepulchres of the ancient Palmyrenes, which they had scarce passed, when the hills opening on a sudden, they discovered such piles of ruins as they had never seen. They were all of white marble; and beyond them, towards the Euphrates, was a wide level, stretching farther than the eye could reach, totally desolate, without variety, and without bounds. After having gazed some time upon this prospect, which rather exceeded than fell short of their expectations, they were conducted to one of the huts of the Arabs, of which there are about 30 in the court of the great temple. The inhabitants of both sexes were well shaped, and the women, though very swarthy, had good features. They were veiled, but did not so scrupulously conceal their faces as the eastern women generally do. They paint the ends of their fingers red, their lips blue, and their eyebrows and eyelashes black. They had large rings of gold or brass in their ears and nostrils, and appeared to be healthy and robust. The walls of the city are flanked by square towers, into which some ancient funeral monuments have been converted; but the walls are in most places level with the ground, and sometimes not to be traced. It is, however, probable, by their general direction, that they included the great temple, and are three miles in circumference. The Arabs showed a tract which was near ten miles in circumference, the soil of which was raised

Palmyra. raised a little above the level of the desert: this, they said, was the extent of the old city; and that by digging in any part of it ruins were discovered.

These ruins consist of temples, palaces, and porticoes of Grecian architecture; and lie scattered over an extent of several miles. They were accidentally discovered by some English travellers from Aleppo somewhat more than a century ago. By far the most remarkable of them is the Temple of the Sun, of which the ruins are spread over a square of 220 yards. It was encompassed with a stately wall, built of large square stones, and adorned with pilasters within and without, to the number of 62 on a side. Within the court are the remains of two rows of very noble marble pillars 37 feet high, with their capitals of most exquisite workmanship. Of these only 58 remain entire; but there must have been many more, for they appear to have gone round the whole court, and to have supported a double piazza. The walks on that side of the piazza which is opposite to the front of the castle seem to have been the most spacious and beautiful. At each end of this line are two niches for statues, with their pedestals, borders, supporters, and canopies, carved with the utmost propriety and elegance. The space within this enclosure, which is now filled with the dirty huts of the inhabitants, seems to have been an open court, in the middle of which stood the temple, encompassed with another row of pillars of a different order, and much taller, being 50 feet high; but of these 16 only remain. The whole space contained within these pillars is 59 yards in length, and near 28 in breadth. The temple is no more than 33 yards in length, and 13 or 14 in breadth. It points north and south; and exactly into the middle of the building, on the west side, is a most magnificent entry, on the remains of which are some vines and clusters of grapes, carved in the most bold and masterly imitation of nature that can be conceived. Just over the door are discerned a pair of wings, which extend its whole breadth; the body to which they belonged is totally destroyed; and it cannot now certainly be known whether it was that of an eagle or a cherub, several representations of both being visible on other fragments of the building. It is observed of the windows of this building, which were not large, that they were narrower at the top than below. The north end of the building is adorned with the most curious fretwork and bas relief; and in the middle there is a dome or cupola about ten feet diameter, which appears to have been either hewn out of the rock, or moulded of some composition which by time is grown equally hard. North of this place is an obelisk, consisting of seven large stones, besides its capital and the wreathed work about it. It is about 50 feet high; and, just above the pedestal, is 12 feet in circumference. There was probably a statue upon it, which the Turks, in their zeal against idolatry destroyed. At about the distance of a quarter of a mile from this pillar, to the east and west, are two others, besides the fragment of a third; so that perhaps they were originally a continued row.

About 100 paces from the middle obelisk, straight forward, is a magnificent entry to a piazza, which is 40 feet broad, and more than half a mile in length, enclosed with two rows of marble pillars 26 feet high, and eight or nine feet in compass. Of these there still remain 129; and, by a moderate computation, there could not originally have been less than 560. The upper end of the piazza was shut in by a row of pillars, standing somewhat closer than those on each side A little to the left are the ruins of a stately building which appears to have been a banqueting house. It is built of better marble, and is finished with yet greater elegance, than the piazza. The pillars which supported it were of one entire stone, which is so strong, that one of them which is fallen down has received no injury. It measures 22 feet in length, and in compass 8 feet 9 inches. In the west side of the piazza are several apertures for gates into the court of the palace. Each of these was adorned with four porphyry pillars, not standing in a line with those of the wall, but placed by couples in the front of the gate facing the palace, two on each side. Two of these only remain entire, and but one standing in its place. They are 30 feet long and 9 in circumference. On the east side of the piazza stands a great number of marble pillars, some perfect, but the greater part mutilated. In one place 11 are ranged together in a square: the space which they enclose is paved with broad flat stones, but there are no remains of a roof. At a little distance are the remains of a small temple, which is also without a roof, and the walls are much defaced. Before the entry, which looks to the south, is a piazza supported by six pillars, two on each side of the door, and one at each end. The pedestals of those in front have been filled with inscriptions both in the Greek and Palmyrene languages, which are become totally illegible. Among these ruins are many sepulchres; they are ranged on each side of a hollow way, toward the north part of the city, and extend more than a mile. They are all square towers, four or five stories high. But though they are alike in form, yet they differ greatly in magnitude and splendour. The outside is of common stone, but the floors and partitions of each story are marble. There is a walk across the whole building, just in the middle; and the space on each hand is subdivided into six partitions by thick walls. The space between the partitions is wide enough to receive the largest corpse; and in these niches there are six or seven piled upon one another.

Many inscriptions have been found at Palmyra, which have occupied much of the attention of the learned; and if any thing certain could be derived from them, there is no doubt but they would tend very considerably to the elucidation of ancient history. See Barthelemi's Reflections on the Palmyrene Alphabet, published at Paris in 1754; and *An Explication* of the inscriptions at Palmyra hitherto published, by John Swinton of Christ church, Oxford. See also Phil. Transf. N° 217. and 218.; the first volume of the Ancient Universal History; and, above all, consult the *Ruins of Palmyra, or Tadmor in the Desert*, published by Mr R. Wood, who, with M. Bouverie and Mr Dawkins, travelled thither in 1751. The result of their observations was published in 1753, in the form of an atlas. The ruins of this once mighty and celebrated city are represented in 57 copperplates, 16 by 12 inches, printed on imperial paper. The are admirably executed; the drawing is correct and masterly; and the graving highly finished: nor can they fail to give satisfaction to those who are connoisseurs in the art, or to those who delight

Palmyra, Palpable.

delight in the labours of antiquity. In a work like ours, however, it is impossible to give these views at length; we shall content ourselves then, after referring to this splendid work, with a view of the ruins of the Temple of the Sun, and of some other miscellaneous ruins.

Plate CCCLXXII.

Palmyra was visited by Mr Bruce before his journey into Abyssinia; but, on account of the many publications concerning these celebrated ruins, he has declined saying much concerning them. He informs us, that, before he came in sight of the ruins, he ascended a hill of white gritty stone, in a very narrow winding road, such as is called a pass; but on getting up to the top his eyes were struck with the most stupendous sight which, he believes, ever mortal saw. The whole plain below, which is very extensive, was so covered with magnificent buildings, that they seemed to touch one another. All of them are finely proportioned, agreeably shaped, and composed of white stones, which at that distance appeared like marble. In taking a draught of these ruins, Mr Bruce divided the whole into six angular views, for which the situation of the place is very convenient. The columns are all uncovered to the very bases, the ground on which they are built being hard and solid. The views he took were upon large paper; some of the columns being represented a foot long, and some of the figures in the foreground of the Temple of the Sun (a magnificent building which stood at one end of the town) being near four inches. Before he left Palmyra he observed its latitude with a reflecting quadrant of Hadley; but as the instrument was out of order, he could not determine it exactly. In his opinion, however, 33° 58′ is not far distant from truth. From such observations as he could make on the longitude, he concluded it to be 37° 9′ east from Greenwich. Mr R. Wood makes the latitude 34° north.

From Palmyra Mr Bruce proceeded to Baalbec, distant about 130 miles, where he found ruins still more magnificent. The interior part of the great temple at this place, according to our author, surpasses any thing he had seen at Palmyra, or anywhere else. "All these views of Palmyra and Baalbec (says he) are now in the king's collection. They are the most magnificent offering, in their line, that ever was made by one subject to his sovereign."—In the neighbourhood of Palmyra are some salt marshes; and to the adjacent country a trade is carried on in kelp from Tripoli in Syria. There are two Arab tribes, almost equally powerful; one of them, called Annecy, remarkable for the finest horses in the world. They possess the country to the south-west, at the back of Libanus, about Bozrah, and southward towards the borders of Arabia Petræa and Mount Horeb. The other tribe, named Mowalii, inhabit the plains east from Damascus, to the Euphrates, and north to near Aleppo. They are fewer in number than the Annecy, but much better soldiers; and their breed of horses not greatly inferior.

Respecting the latitude and longitude there are still various opinions: that which appears to be nearest the truth is E. Long. 38. 50. N. Lat. 33. 20. It stands about 50 leagues south-east of Aleppo, as much from Damascus, and 20 leagues west of the Euphrates.

PALPABLE, something perceivable by the senses, particularly that of feeling.

Palpitation || Paly.

PALPITATION *of the Heart*. See MEDICINE, N° 97. 290.

PALSGRAVE (John), a learned writer, who flourished in the reigns of Henry VII. and Henry VIII. He received his grammatical learning at London, his native place. He studied logic and philosophy at Cambridge, at which university he resided till he became bachelor of arts; after which he went to Paris, where he spent several years in the study of philosophy and other parts of learning, took the degree of master of arts, and acquired such excellence in the French tongue, that in 1514, when a treaty of marriage was negotiated between Louis XII. king of France, and the princess Mary, sister of Henry VIII. of England, Mr Palsgrave was appointed to be her tutor in that language. But Louis XII. dying soon after his marriage, Palsgrave attended his fair pupil back to England, where he taught the French language to many of the young nobility, obtained good preferment in the church, and was appointed by the king one of his chaplains in ordinary. In 1531 he settled at Oxford for some time, and the next year was incorporated master of arts there, as he had before been in Paris, and a few days after was admitted to the degree of bachelor of divinity. At this time he was much esteemed for his learning; and, what is very remarkable, though an Englishman, he was the first who ever reduced the French language to grammatical rules, or that had attempted to fix it to any kind of standard. This he undertook, and executed with great ingenuity and considerable success, in a large work which he published in that language at London, entitled *L'Eclairciſſment de la Language Françoiſe*, in three books in thick folio, 1530, to which he has prefixed a large English introduction; so that the French nation seems to stand originally indebted to the English for that universality which the language at present possesses, and on which they so much pride themselves. He translated into English a Latin comedy called *Acolastus*, written by one Will. Fullonius, an author then living at Hagen in Holland.

At what time Mr Palsgrave was born, or how long he lived, it is not easy to say; yet, from the concurrence of several facts, he appears to have been much less than 60 years of age at the time of his publishing the above-mentioned translation, which was in the year 1540.

PALSY. See MEDICINE, N° 92. 265, &c. and 269.

PALUDAMENTUM, in Roman antiquity, a habit that differed but little from the chlamys, except that this last belonged chiefly to the lower class of people. It was worn by the officers and principal men among the Romans in time of war, who are therefore called *Paludati*; which distinguished them from the common soldiers, who, because they wore the sagum, were called the *Sagati*. The paludamentum came down only to the navel, was open on the sides, had short sleeves resembling angels wings, and was generally white or red. It is sometimes used to signify the common soldier's coat.

PALUS MEOTIS, the ancient name of a gulf between Europe and Asia, to the north of the Black sea, now called the *sea of Zabach*, or *Asoph*.

PALY, or PALE, in heraldry, is when the shield is divided

Ruins of the Ancient City of Palmyra.

The Remains of the Great Temple of the Sun in Palmyra from the West.

A. Bell Prin. Wale Sculptor fecit.

Paly divided into four or more equal parts, by perpendicular lines falling from the top to the bottom.

Pan. *Paly Bende*, is when the escutcheon is divided by perpendicular lines, which is *paly*; and also by diagonals, which is called *bendy*.

PAMBOUK, the Turkish name of the ruined city of Hierapolis. See Hierapolis.

PAMPELUNA, the capital of the kingdom of Navarre in Spain, with a very strong citadel and rich bishopric. It is handsome and populous, and carries on a great trade, seated on a very fertile plain, in E. Long. 1. 25. N. Lat. 42. 42.

Pampeluna, a town of New Granada in South America, famous for its gold mines and numerous flocks of sheep. W. Long. 68. 30. N. Lat. 6. 30.

PAMPHILUS, a celebrated painter of Macedonia, in the age of Philip. He was founder of the school for painting at Sicyon; and he made a law which was observed not only in Sicyon but all over Greece, that none but the children of noble and dignified persons should be permitted to learn painting. Apelles was one of his pupils.

PAMPHYLIA, the ancient name of a country of Natolia, in Asia, now called *Carimania* and *Cay-bay*, between Lycia and Cilicia, on the south coast, to the north of the Mediterranean sea.

PAN, the god of shepherds, hunters, and all country exercises. Such he is described by the Greek and Roman poets; but he bore a higher character among the earliest Greeks, as well as among the Egyptians; from whom his worship was borrowed by that people. In Egypt he was known by the name of *Mendes*, which, according to Jablonski ‡, signifies fecundity. Hence his symbol was a living he goat, the most salacious of all animals: "Hircum Mendesium colunt Ægyptii, eo quod virtuti prolificæ ac genitivæ, consecratus est.—Nam animal hoc coitus valde cupidum est." His principal temple was a magnificent building in a city of Lower Egypt, called after his name. It is well known (see Polytheism) that from dedicating certain animals to certain gods, the Egyptians proceeded to consider the animals themselves as actuated by the divinities to whom they were sacred. Hence the origin of brute worship. In the temple of Mendes was kept a *he goat*, to whom sacrifices of a very monstrous kind were offered. Herodotus, speaking of the præfecture of *Mendes*, says †, *Εγενετο δ' εν τω νομω τουτω επ' εμευ τουτο το τερας γυναικι τραγος εμισγετο αναφανδον. Τουτο ες επιδειξιν ανθρωπων απικετο.* Our readers, learned and unlearned, will forgive us for not translating this passage, which contains, however, nothing that is not confirmed by the testimony of other writers; particularly Plutarch, and Pindar as he is quoted by Strabo. The most wonderful circumstance of this monstrous sacrifice is, that it was made publicly in the presence of a great concourse of men! But to what divinity was it made? To a mere goat, or to some superior principle animating the goat? Doubtless to the latter; for it is said that the fair worshippers were of the first rank, and of unspotted fame; and that if they had borne a different character, the deity would not have accepted of their devotions.

‡ Pantheon Ægyptiorum.

† Lib. ii. ch. 26.

The deity whom the Egyptians adored by the name of *Mendes*, was no other than the Soul of the Universe; for he was their most ancient god: and we are told by Plutarch ‡, "That they took the first God and the Universe for one and the same thing." Hence his name Παν among the Greeks: not that either the Greeks or their masters in theology worshipped, as the first god, mere brute matter, but that spirit which they conceived to be coeternal with matter, and to animate all things, making them *one*. Thus Orpheus, who imported the Egyptian doctrine into Greece, declares that all things are one: and after him Parmenidas, and other philosophers, taught, *εν ειναι το παν*, that "one is the universe;" and that "the universe is immoveable." That the ancient Grecian *Pan*, or the Egyptian *Mendes*, was not the corporeal world, as senseless and inanimate, but the whole system of things, animated and eternal, appears further from the following testimony of Macrobius. "Hunc deum Arcades colunt, appellantes *τον της υλης κυριον*, non sylvarum dominum, sed universæ substantiæ materialis dominatorem:—The Arcadians worship this god, calling him the lord of Hyle; *i. e.* not the lord of the woods, but the lord of all material substance." In the same manner, Pharnutus † describes the Pan of the other Greeks, not as the mere corporeal world, but as the intellectual principle actuating it and presiding over it: and he adds, that "Pan was feigned to be lascivious, because of the multitude of *spermatic reasons* in the world, and the continual mixtures and generation of things."

‡ De Isid. et Osir.

† Inter Thom. Gale Script res Mythol. vet.

The Egyptians, as we learn from Jablonski, had nearly the same notion with the Greeks of the spirit which they worshipped as the Soul of the Universe; only they gave to it both sexes. As the maker, governor, and bountiful father of universal nature, they considered it as a *male*, whose symbol was the *he goat* of Mendes; and as a *female* it was adored by the name of *Isis*, to whom the *she goat* was consecrated, though not held in such veneration as the male. From this view of the Egyptian creed, the sacrifice which we have mentioned appears no longer unaccountable. It was made to a god, believed to be the universal source of fecundity, and to whom, from the well-known character of the animal, whom he was supposed to actuate, they had reason to believe it would be most acceptable.

The Greeks never worshipped their Pan by the emblem of a living goat; but they painted him with the lower parts of a goat, for a reason which shall be afterwards mentioned. How he came to degenerate among that people, from one of the *Dii majorum gentium* or rather from the first principle of all things, to the rank of a demon or demi-god, we cannot pretend to say: but that such was his fate, is certain; for under this last character mention is made both of his birth and his death.

Whose son he was, is not agreed among them. Homer makes him the son of Mercury, and says he was called *Pan* from *παν*, *omne*, because he charmed all the gods with his flute; others say that he was the son of Demogorgon, and first invented the organ, of seven unequal reeds, joined together in a particular manner: Having on a time fought with Cupid, that god in spite made him fall in love with the coy nymph Syrinx, who, flying from him to the banks of Ladon, a river of Arcadia, at the instant prayers of the Nymphs was turned into

Pan.

a reed, as her name in Greek signifies, which the god grasping instead of her, made a pipe of it, and for his music was adored by the Arcadians. The most common opinion was, that he was the son of Mercury and Penelope. But *Nat. Comes*, out of *Duris Samius*, makes his birth scandalous, by saying he was called Παν, because begot by all Penelope's suitors. He was painted half man half goat, having large goats horns, a chaplet of pine on his red face, a pleasant laughter, with the feet and tail of a goat; a motely skin covering his body, with a crooked stick in one hand and his pipe in the other. See him nicely described by *Sil. Ital.* 13. 326. *et seq.* a fight enough to fright women and children, yea, armed men too; for when Brennus the Gaul was about to pillage the temple of Apollo at Delphos, he by night struck such a terror into his army, that he quitted his sacrilegious design: hence *Panici terrores*. Yet, as homely as he was, he pleased the goddess Luna, turning himself easily into a white ram, Virgil, Georg. III. 392. *et deinceps*; and the nymph Dryope also, almost putting off his divinity, and turning shepherd for her sake. Neither was he displeasing to other nymphs, who are generally made dancing round about him to hear the charms of his pipe. The usual offerings made him were milk and honey, in shepherds wooden bowls; also they sacrificed to him a dog, the wolf's enemy; whence his usual epithet is Λυκαιος; and whence also his priests were called *Luperci*.

His festival was celebrated on February 15. by the Romans, brought into Italy by Evander the Arcadian, and revived afterwards by Romulus, in memory of his preserver. He was also called by the Romans *Inuus*, ab ineundo. *Vid.* Liv. I. 5. Macrob. Sat. I. 22. and Serv. in Virg. Æn. VI. 775. The ancients, by giving so many adjuncts and attributes to this idol as we have observed above, seem to have designed him for the symbol of the universe; his upper parts being human, because the upper part of the world is fair, beautiful, smiling, like his face; his horns symbolize the rays of the sun and of the moon; his red face, the splendour of the sky; the spotted skin wherewith he is clothed, the stars which bespangle the firmament; the roughness of his lower parts, beasts and vegetables; his goat's feet, the solidity of the earth; his pipe, compact of seven reeds, the seven planets, which they say make the harmony of the spheres: his crook, bending round at the top, the years circling in one another. *Serv. Interpr.*

Having said so much of Pan, both as a self-existent god and as a generated demon, we shall conclude the article with some observations on Plutarch's account of the prodigy which happened at his death; for in the Pagan creed, demons were not all believed immortal.—"In the reign of Tiberius (says our author †), certain persons on a voyage from Asia to Italy, and sailing towards the evening by the Echinedes, were there becalmed, and heard a loud voice from the shore calling on one Thamus an Egyptian pilot whom they had on board. Thamus, as may be supposed, listened with attention; and the voice, after repeating his name thrice, commanded him when he came to the Pelodes, to declare that the *Great Pan* was dead. The man, with the advice of his companions, resolved, that if they should have a quick gale off the Pelodes, he would pass by in silence; but that if they should be becalmed, he would perform what the voice had commanded. Adhering to this resolution, they soon arrived off the destined islands, and were immediately becalmed, there being neither breath of wind nor agitation of water. Upon this Thamus looking from the hinder part of the ship towards the land, pronounced with a loud voice ὁ μεγας Παν τεθνηκε, *The Great Pan is dead!* and was instantly answered from the shore by numberless howlings and lamentations.

† *Lib. de Orac. Def.*

This story, which has so much the air of imposture, has not only been admitted as truth by men of the first eminence for learning and acuteness, but has been applied to our Saviour, whose death (says Cudworth) the demons mourned, not from love, but from a presage that it would put a period to the tyranny and domination which they had so long exercised over the souls and bodies of men. In support of this opinion, he quotes several passages of Scripture, such as, "Now is the prince of this world judged;" and, "Having spoiled principalities and powers (by his death upon the cross), he triumphed over them in it." He affirms likewise, that "Pan being taken for that reason or understanding by which all things were made, and by which they are all governed, or for that divine wisdom which diffuseth itself through all things, is a name which might very well signify *God manifested in the flesh*.

The authority of Cudworth is great; but a groundless opinion has seldom been propped by weaker reasoning than he makes use of on this occasion. Plutarch indeed says, and seems to believe, that this prodigy fell out during the reign of Tiberius; but as he mentions not the year of that reign, there is no evidence that it was at the crucifixion of our Saviour. The demons who inhabited the Echinedes knew what had been transacted at Jerusalem far distant from their islands; they knew the name of the pilot of a strange ship; they knew that the mariners of that ship had resolved to disobey their command, unless becalmed off the Pelodes; they had power over both the winds and waves at the *Pelodes*, and exerted that power to enforce obedience to their command; and yet these all-knowing and powerful beings were under the necessity of calling in the aid of a *man* to deliver a message to their companions, inhabiting a place to which the very same story assures us that their own power and knowledge reached. Should it be said that the demons were compelled by divine power thus publicly to make known to man Christ's triumph over the kingdom of darkness, we beg leave to ask why they were not likewise compelled to give him another name, since it is certain, that at the era of Tiberius, and long before, illiterate Pagans, such as common seamen must be supposed to have been, knew no other *Pan* than the fabled son of Penelope and Mercury?—Indeed the other Pan, taken for that reason or understanding by which all things were made, could not possibly be the being here meant; for, erroneous as the Pagan system was, there is nothing in it so completely absurd as the death of the soul of the universe, the maker of all things; nor do we believe that any Pagan ever existed, who dreamed that such a death was possible.

What then, it will be asked, are we to understand by

by this story? Plutarch was eminent for knowledge and integrity, and he relates it without expressing a doubt of its truth. He does so; but many a man of worth has been credulous; and though that was not his character, this *prodigy* may be accounted for by natural means. Germanicus was believed to have been poisoned, at least with the knowledge, if not by the command, of Tiberius; and there was nothing which the Romans so deeply deplored as the untimely death of that accomplished prince ‡. They fancied that his body was animated, not by a human soul, but by a superior demon; and they decreed to him statues, religious ceremonies, and even sacrifices. His widow was highly honoured, as having been nearly related to a divinity, and his children were adored as demi-gods. These facts being admitted, nothing appears to us more probable than the opinion of the learned Mosheim †, who thinks that some shrewd statesmen, in order to excite the popular fury against Tiberius to the highest pitch, invented this story, and bribed foreign mariners to spread it among the people, who would naturally believe, that by the great Pan was meant their favourite Germanicus. This hypothesis is at least countenanced by what Plutarch tells us of the anxiety of the emperor to discover what personage could be meant by the Pan whose death was announced to the seamen: he consulted the learned men of Rome, who, in order to restore peace to the city, declared that they understood it of none other than the son of Penelope and Mercury.

‡ *Tacit. Annal.* Lib. II. cap. 72. 83. *et* Lib. III. cap. 1.

† *Cudworth's Intel. Syst.* cap. 4. note 13

PANACEA, among physicians, denotes an universal medicine, or a remedy for all diseases; a thing impossible to be obtained.

PANADA, a diet consisting of bread boiled in water to the consistence of pulp, and sweetened with a little sugar.

PANAMA, the capital city of the province of Darien in South America, where the treasures of gold and silver, and the other rich merchandises of Peru, are lodged in magazines till they are sent to Europe. W. Long. 82. 15. N. Lat. 8. 57.

When Guzman first touched at this place in 1514, it consisted entirely of fishermen's huts. Orius d'Avila settled a colony here in a few years after, and in 1521 it was constituted a city by the emperor Charles V. with the proper privileges. In 1670 it was sacked and burnt by John Morgan, an English adventurer, who had the preceding year taken Porto Bello. This misfortune induced the inhabitants to remove the city to its present situation, distant about a league from the place where it stood before. For the greater security, the new city was enclosed by a freestone wall, and the houses were built of stone and brick. Since that time several bastions have been added, and now there is always a complete garrison maintained, and the walls are mounted with large cannon. But all these precautions could not save this city from another misfortune; it was entirely consumed by fire in the year 1737. After this accident it was again rebuilt, in the manner as it now stands, with neat elegant houses, but not magnificent. The inhabitants are rather independent in their fortunes than rich; there are few of them opulent, and scarce any in a state of poverty. As to the harbour, it is convenient, and well secured against storms by a number of surrounding islands, and is capable of containing the largest fleets. Here the royal audience is seated, at which the governor of Panama resides; for which reason the city is commonly deemed the capital of the province.



This place, a little while after it was founded, became the capital of the kingdom of Terra Firma. Some hopes were at first entertained from the three provinces of Panama, Darien, and Veragua, which composed it; but this prosperity vanished instantaneously. The savages of Darien recovered their independence; and the mines of the two other provinces were found to be neither sufficiently abundant, nor of an alloy good enough to make it worth while to work them. Five or six small boroughs, in which are seen some Europeans quite naked, and a very small number of Indians who have come to reside there, form the whole of this state, which the Spaniards are not ashamed of honouring with the great name of kingdom. It is in general barren and unwholesome, and contributes nothing to trade but pearls.

The pearl fishery is carried on in the islands of the gulf. The greatest part of the inhabitants employ such of their negroes in it as are good swimmers. These slaves plunge and replunge in the sea in search of pearls, till this exercise has exhausted their strength or their spirits.

Every negro is obliged to deliver a certain number of oysters. Those in which there are no pearls, or in which the pearl is not entirely formed, are not reckoned. What he is able to find beyond the stipulated obligation, is considered as his indisputable property: he may sell it to whom he pleases; but commonly he cedes it to his master at a moderate price.

Sea monsters, which abound more about the islands where pearls are found than on the neighbouring coasts, render this fishing dangerous. Some of these devour the divers in an instant. The manta fish, which derives its name from its figure, surrounds them, rolls them under its body, and suffocates them. In order to defend themselves against such enemies, every diver is armed with a poniard: the moment he perceives any of these voracious fish, he attacks them with precaution, wounds them, and drives them away. Notwithstanding this, there are always some fishermen destroyed, and a great number crippled.

The pearls of Panama are commonly of a very fine water. Some of them are even remarkable for their size and figure: these were formerly sold in Europe. Since art has imitated them, and the passion for diamonds has entirely superseded or prodigiously diminished the use of them, they have found a new mart more advantageous than the first. They are carried to Peru, where they are in great estimation.

This branch of trade has, however, infinitely less contributed to give reputation to Panama, than the advantage which it hath long enjoyed of being the mart of all the productions of the country of the Incas that are destined for the old world. These riches, which are brought hither by a small fleet, were carried, some on mules, others by the river Chagre, to Porto Bello, that is situated on the northern coast of the isthmus which separates the two seas. See DARIEN.

PANARI, one of the Lipari islands, lying in the Tuscan sea. It is only five miles in circumference,

Panaro, Panathenæa.

and the soil s barren. E. Long. 15. 0. N. Lat. 39. 0.

PANARO, a river of Italy, which rises in the Apennines, crosses the valley of Frignano, and running on the confines of the Modenese and Bolognese, waters Fenal, and falls into the Po at Bondeno, ten miles above Ferrara.

PANATHENÆA, παναθηναια, in Grecian antiquity, an ancient Athenian festival, in honour of Minerva the protectress of Athens, and called *Athenæa*. Harpocration and Suidas refer the institution of this festival to Erichthonius IV. king of Athens, who lived before Theseus. Theodoret alone says the feast was established by Orpheus. Be this as it will, till Theseus it was only a particular feast of the city of Athens, and was simply called *Athenæa*: but that prince, uniting all the people of Attica into one republic, they afterwards all assisted at the feast; whence the name *Panathenæa*, i. e. the feast of all Attica. In effect all Attica was present; and each people sent a bullock for the sacrifices, and for the entertainment of the vast multitude of people assembled.

There were two festivals under this denomination, the greater and the lesser. The greater panathenæa were exhibited every five years; the less every three, or, according to some writers annually. Though the celebration of neither, at first, employed more than one day: yet in aftertimes they were protracted for the space of many days, and solemnized with greater preparations and magnificence than at their first institution.

The ceremonies were the same in the great and the little panathenæa; excepting for a banner, wherein the actions of the goddess were represented in embroidery, performed by maids, with the names of those who had distinguished themselves in the service of the republic: which was only borne at the greater.

Prizes were established there for three different kinds of combat: the first consisted of foot and horse races; the second, of athletic exercises; and the third, of poetical and musical contests. These last are said to have been instituted by Pericles. Singers of the first class, accompanied by performers on the flute and cithara, exercised their talents here, upon subjects prescribed by the directors of these exhibitions.

The following is the order observed in this festival, according to M. Barthelemi, who quotes numerous authorities on the occasion: "The inhabitants of the different towns of Attica thronged to the capital, leading with them a great number of victims destined for sacrifices to the goddess. In the first morning were the horse races, in which the sons of the first citizens of Athens contended for the honour of the victory. In the stadium were other young men struggling for the prize of wrestling, and different exercises of the body; and in the Odium were several musicians engaged in gentler and less perilous contests. Some executed pieces on the flute or cithara; others sang, and accompanied their voices with one of these instruments. The subject proposed to them was the eulogium of Harmodius, Aristogiton, and Thrasybulus, who had rescued the republic from the yoke of the tyrants by which it was oppressed: for among the Athenians, public institutions are so many monuments for the citizens who have served the state, and lessons for those who are called upon to render it service. A crown of olive, and a vessel filled with oil, were the prizes bestowed upon the victors. Crowns were afterwards conferred on individuals, who appeared to the people to have merited that mark of honour by their zeal in the service of their country.

Anach. Vol. ii. p. 434.

"At the Ceramicus passed a procession, formed without the walls, and which began at that a place to file off. It was composed of different classes of citizens crowned with chaplets of flowers, and remarkable for their personal beauty. Among the number were old men of a majestic and venerable appearance, bearing branches of olive; middle aged men, who, armed with lances and with bucklers, seemed only to respire war; youth from eighteen to twenty, who sang hymns in honour of the goddess; beautiful boys clad in a simple tunic, adorned only with their native graces; and, lastly, girls who were of the first families in Athens, and whose features, shape, and deportment, attracted every eye. With their hands they held baskets on their heads, which, under a rich veil, contained sacred utensils, cakes, and every thing necessary for the sacrifices. Female attendants who followed them, with one hand held over them an umbrella, and carried in the other a folding chair. This is a species of servitude imposed on the daughters of all foreigners settled at Athens; a servitude they share in common with their fathers and mothers, who likewise carried on their shoulders vessels filled with water and honey, for the purpose of libations. They were followed by eight musicians; four of whom played on the flute and four on the lyre. After them came rhapsodists singing the poems of Homer; and dancers armed at all points, who, attacking each other at intervals represented to the sound of the flute, the battle of Minerva with the Titans. Next came a ship that appeared to glide over the ground by the power of the wind, and the efforts of a great number of rowers, but which really was put in motion by concealed machinery. The vessel had a sail of light stuff, on which young girls had represented in embroidery the victory of Minerva over the Titans. On it also they had depicted, by order of the government, some heroes whose illustrious deeds had merited to be celebrated with those of the gods. This procession marched on with solemn steps, under the direction of several magistrates; and traversed the most frequented quarter of the city amidst a crowd of spectators, most of whom were placed on scaffolds erected for the occasion. When it had reached the temple of the Pythian Apollo, the sail of the ship was taken down and carried to the citadel, where it was deposited in the temple of Minerva.

"In the evening, at the academy, was the torch race. The course is only six or seven stadia in length. It extends from the altar of Prometheus, which is at the gate of this garden, to the walls of the city. Several young men are stationed in this interval at equal distances. When the shouts of the multitude have given the signal, the first lights his flambeau at the altar, and, running with it, hands it to the second, who transmits in the same manner to the third, and so successively. He who suffers it to be extinguished can no more enter the lists; and they who slacken their pace are exposed to the railleries, and even blows, of the

Panax. the populace. To gain the prize, it is necessary to have passed through the different stations with success. This trial of skill was frequently repeated, and is diversified according to the nature of the festivals.

"The candidates who had been crowned at the different exercises invited their friends to supper. Sumptuous repasts were given in the prytaneum and other public places, which lasted till the following day. The people among whom the immolated victims were distributed spread tables on every side, and gave a loose to their lively and tumultuous mirth."

PANAX, GINSENG: A genus of the diœcia order, belonging to the polygamia class of plants. There are five species of this plant. 1. Quinquefolium. 2. Trifolium. 3. Fruticosum. 4. Arborea. 5. Spinosa.

Plate CCCLXXIII. The first and second are natives of North America. The quinquefolium is generally believed to be the same with the Tartarian ginseng; the figures and descriptions of that plant which have been sent to Europe by the missionaries agreeing perfectly with the American plant. This hath a jointed, fleshy, and taper root, as large as a man's finger, frequently divided into two smaller fibres downwards. The stalk rises near a foot and a half high, and is naked at the top, where it generally divides into three smaller footstalks, each sustaining a leaf composed of five spear-shaped lobes, sawed on their edges: they are of a pale green, and a little hairy. The flowers grow on a slender footstalk, just at the division of the footstalks which sustain the leaves, and are formed into a small umbel at the top: they are of a herbaceous yellow colour, composed of small yellow petals, which are recurved. Woodville † says they are white; that they are produced in a roundish terminal umbel, and are hermaphrodite or male on separate plants. The former (see the Plate) stand in close simple umbels: the involucrum consists of several small, tapering, pointed, permanent leaves; the proper calyx is tubular, and divided at the rim into five small teeth: the corolla consists of five petals, which are small, oval, equal, and reflexed: the filaments are five, short, and furnished with simple antheræ: the germen is roundish, placed below the corolla, and supports two short erect styles, crowned by simple stigmata: the fruit is an umbilicated two-celled berry, each containing a single irregularly heart-shaped seed. The flowers appear in the beginning of June; and are succeeded by compressed, heart-shaped berries, which are first green, but afterwards turn red; enclosing two hard, compressed, heart-shaped seeds, which ripen in the beginning of August. The second sort grows naturally in the same countries: but Mr Miller never saw more than one plant, which was sent to him from Maryland, and did not live beyond the first year: being planted in a dry soil, in a very dry season. The stalk was single, and did not rise more than five inches in height dividing into three footstalks, each sustaining a trifoliate leaf, whose lobes were longer, narrower, and deeper indented on their edges, than the former. The flower stalk rose from the divisions of the footstalk of the leaves; but before the flowers opened, the plant decayed.

† *Medical Botany.*

Ginseng was formerly supposed to grow only in Chinese Tartary, affecting mountainous situations, shaded by close woods; but it has now been long known that this plant is also a native of North America, whence M. Sarrasin transmitted specimens of it to Paris in the year 1704 (A); and the ginseng since discovered in Canada, Pennsylvania, and Virginia, by Lafiteau, Kalm, Bartram, and others, has been found to correspond exactly with the Tartarian species; and its roots are now regularly purchased by the Chinese, who consider them to be the same as those of eastern growth, which are known to undergo a certain preparation, whereby they assume an appearance somewhat different. For it is said, that in China the roots are washed and soaked in a decoction of rice or millet seed, and afterwards exposed to the steam of the liquor, by which they acquire a greater firmness and clearness than in their natural state (B). The plant was first introduced into England in 1740 by that industrious naturalist Peter Collinson. It thrives in those places where it hath a light soil and shady situation, and will produce flowers and seeds; but the latter, though in appearance ripe and perfect, will not produce any new plants, as Mr Miller says he has repeatedly made the experiment, and waited for them three years without disturbing the ground. There are many good specimens in the Royal Botanic Garden at Kew.

*Woodville's Medical Botany*, Vol. II.

The dried root of ginseng, as imported here, is scarcely the thickness of the little finger, about three or four inches long, frequently forked, transversely wrinkled, of a horny texture, and both internally and externally of a yellowish white colour. On the top are commonly one or more little knots, which are the remains of the stalks of the preceding years, and from the number of which the age of the root is judged of. "To the taste it discovers a mucilaginous sweetness, approaching to that of liquorice, accompanied with some degree of bitterishness, and a slight aromatic warmth, with little or no smell. It is far sweeter, and of a more grateful smell, than the roots of fennel, to which it has by some been supposed similar; and differs likewise remarkably from those roots in the nature and pharmaceutic properties of its active principles, the sweet matter of the ginseng being preserved entire in the watery as well as the spirituous extract, whereas that of fennel roots is destroyed or dissipated in the inspissation of the watery tincture. The slight aromatic impregnation of the ginseng is likewise in good measure retained in the watery extract, and perfectly in the spirituous ‡."

‡ *Lewis*, l. M. p. 325

*Properties*, The Chinese ascribe extraordinary virtues to the root of ginseng; and have long considered it as a sovereign remedy in almost all diseases to which they are liable, having no confidence in any medicine unless in combination with it. It is observed by Jartoux,



(A) Sarrasin was correspondent of the Royal Academy of Sciences, in the history of which his account was published in 1718.

(B) The Chinese value these roots in some measure according to their figure, esteeming those very highly which are regularly forked, or have a fancied resemblance to the human form.

toux, that the most eminent physicians in China have written volumes on the medicinal powers of this plant; asserting, that it gives immediate relief in extreme fatigue either of body or mind; that it dissolves pituitous humours, and renders respiration easy; strengthens the stomach; promotes appetite; stops vomitings; removes hysterical, hypochondriacal, and all nervous affections; and gives a vigorous tone of body even in extreme old age. These, and many other effects of this root equally improbable and extravagant, are related by various authors; and Jartoux was so much biassed by this eastern prejudice in favour of ginseng, that he seems to have given them full credit, and confirms them in some measure from his own experience. He says, "Nobody can imagine that the Chinese and Tartars would set so high a value upon this root, if it did not constantly produce a good effect."—"I observed the state of my pulse, and then took half of that root raw: in an hour after I found my pulse much fuller and quicker; I had an appetite, and found myself much more vigorous, and could bear labour much better and easier than before. But I did not rely on this trial alone, imagining that this alteration might proceed from the rest we had that day: but four days after, finding myself so fatigued and weary that I could scarcely sit on horseback, a Mandarin who was in company with us perceiving it, gave me one of these roots: I took half of it immediately, and an hour after I was not the least sensible of any weariness. I have often made use of it since, and always with the same success. I have observed also, that the green leaves, ard especially the fibrous parts of them, chewed, would produce nearly the same effect †." We know, however, of no proofs of the efficacy of ginseng in Europe; and from its sensible qualities we judge it to possess very little power as a medicine. Dr Cullen says, "We are told that the Chinese consider ginseng as a powerful aphrodisiac; but I have long neglected the authority of popular opinions, and this is one instance that has confirmed my judgment. I have known a gentlemen, a little advanced in life, who chewed a quantity of this root every day for several years, but who acknowledged he never found his faculties in this way improved by it ‡."

† *Phil. Transf* Vol. xxviii p. 239.

‡ *Mat. Med.* Vol. ii p. 161.

A dram of the ginseng root may be sliced and boiled in a quarter of a pint of water to about two ounces; then a little sugar being added, it may be drank as soon as it is cool enough. The dose must be repeated morning and evening; but the second dose may be prepared from the same portion of root which was used at first, for it may always be twice boiled.

PANAY, an island of Asia, and one of the Philippines, lying between those of Paragoa and Negro. It is 250 miles in circumference, and is the most populous and fertile of them all. It is watered by a great number of rivers and brooks, and produces a great quantity of rice. Its shape is triangular. The names of its principal capes are Potol, Naso, and Bulacabi. The coast from Bulacabi to Potol lies east and west; from Potol to Naso, north and south; from Bulacabi to Iloilo, another cape, less than the great ones, is also north and south; from Iloilo to Cape Naso, east and west. The middle of the island is in the latitude of ten degrees. On the north side, almost in the middle between the two capes of Potol and Bulacabi, the famous river Panay falls into the sea; and the mouth of the harbour is covered by a small island called *Lutaya*, in which port the Spaniards had a safe retreat before they discovered and conquered Manilla and Gavité. The fertility of Panay is caused by the many rivers that water it, for there is no travelling a league without meeting a river; but more particularly by the Panay, which gives its name to the island, and runs a course of 40 leagues. The island, for the better administering of justice, is divided into jurisdictions: the first, called *Panay*, contains all that lies between Cape Potol and Bulacabi; the rest of the island is subject to the alcayde of Otton, who resides at Iloilo, a point of land running out into the sea, on the south side, between the two rivers of Tig Bavan and Jaro, and, with the island Imaras, forms a strait not above half a league over, or rather an open harbour. On this point the governor Don Gonzalo Ronquillo caused a fort to be built in the year 1681. The island contains about 16,360 tributary Indians, partly belonging to the king and partly to particular encomienderos or lords; but they all pay in rice, the island producing 100,000 bushels, Spanish measure, and but little other grain. The inhabitants are stout, lusty, and industrious farmers, and expert huntsmen, the country being full of wild boars and deer. The women make cloth of several colours. There are in the island 14 parishes, belonging to the fathers of the order of St Augustin, three benefices of secular priests, and formerly one college of the society of Jesus, where they administer the sacraments to the garrison of Iloilo. Besides the tributary Indians, there are here those blacks the Spaniards call *Negrilloes*, who were the first inhabitants of the island, and afterwards driven into the thick woods by the Bisayas who conquered it. Their hair is not so stiff curled, nor are they so stout and strong, as the Guinea blacks. They live in the most uncouth parts of the mountains with their wives and children, all naked like beasts. They are so swift that they often overtake wild boars and deer. They stay about the dead beast as long as it lasts; for they have no other subsistence but what they acquire with their bow and arrows. They fly from the Spaniards, not so much through hatred as from fear. Among the islands about Panay lies Imaras, opposite to Iloilo, and about a quarter of a league distant. It is long and low, ten leagues in compass and three in length, the soil fertile, abounding in sarsaparilla, and exceeding good water. On the mountains there are wild boars, deer, and good timber. It has also in it the port of St Anne, three leagues from Iloilo.

*Modern Un. Hist.* Vol. viii.



PANCARPUS, in Roman antiquity, a kind of show which the Roman emperors frequently exhibited to the people. The word is formed from the Greek *παν all*, and *καρπος fruit*. Whence the name was also given by the Athenians to a sacrifice wherein all kinds of fruits were offered. In this spectacle, the Circus being all set over with large trees, represented a forest, into which the beasts being let from the dens underground, the people, at a sign given by the emperor, pursued, shot, and killed all they could lay hold of, which they afterwards carried away, to regale upon at home. The beasts usually given on these occasions were boars, deer, oxen, and sheep.

Casaubon, Cujas, Pithou, &c. make the pancarpus and

and sylva the same thing; Salmasius will have them different. The sylva, according to him, was such a diversion as that above described: but the pancarpus a combat, wherein robust people, hired for that purpose, fought with wild beasts: which opinion he confirms from Cassian, Justinian, Claudian, Firmicus, Manilius, and Cassiodorus.

PANCIROLLUS (Guy), a famous lawyer of Rhegium, was a person of an excellent genius, which he cultivated with the greatest care in the principal universities of Italy; and was afterwards ordinary professor of law at Padua. Philibert Emanuel, duke of Savoy, invited him to his university in 1571, where he composed his ingenious treatise *De rebus inventis et deperditis*. But the air of Turin not agreeing with him, he there lost an eye; and for fear of losing the other, returned to Padua, where he died in 1591.

PANCRAS, a town of England, in the county of Middlesex, on the north-west side of London, in the highway to Kentish town. Its church is one of the prebends of St Paul's, of which cathedral some call it the mother, it being thought to be as old as that church even in the reign of Queen Elizabeth, when it is represented as weather-beaten and standing alone, without any company, though it had formerly many buildings about it. In its churchyard lie many Roman Catholics. At a public house on the south side of the church is a medicinal spring.

PANCRATIUM (compounded of παν *all*, and κρατεω *I overcome)*, among the ancients, a kind of intermixed exercise, consisting of the lucta or wrestling, and the boxing or pugilate: but it differs in this, that as the athletæ are not to seize the body, their hands are not armed with gauntlets, and give less dangerous blows.

The *pancratium* was the third gymnastic exercise, and was not introduced till long after the others. The people who were engaged in these exercises were called *pancratiastæ*; which name was also given to such as did not confine themselves to one exercise, but succeeded in several different ones.

Barthelemi, in his Travels of Anacharsis, gives us a short account of one of those at which he supposes him to have been present, in these words: "The action was soon terminated: a Sicyonian named *Sostratus*, a champion celebrated for the number of prizes he had won, and the strength and skill which had procured them, had arrived the preceding day. The greater part of the combatants yielded up all pretensions to the crown as soon as he appeared, and the others on the first trial; for in those preliminary essays, in which the athletæ try their strength by taking each others hands, he squeezed and twisted the fingers of his adversaries with such violence as instantly to decide the victory in his favour."

*Anacharsis*, Vol. III.

PANCREAS, in anatomy. See there, N° 95.

PANDA, in mythology, a goddess who was invoked and honoured as the protectress of travellers and navigators. The goddess of peace was also called *Pandar*, because she opened the gates of cities which were shut in time of war. According to Varro, Panda is a surname of Ceres, derived *à pane dando*, because she gave bread to mankind.

PANDATARIA (Suetonius, Pliny, Strabo); PANDATERIA (Mela, Tacitus): An island in the Tuscan sea: a place of banishment for the more illustrious exiles. Hither Julia, the daughter of Augustus, was banished for her incontinence. To this island Tiberius banished Agrippina, his daughter-in-law (Suetonius). It was the place of confinement of Octavia the daughter of Clodius, married to Nero; a sight that affected every eye (Tacitus). Now *Santa Maria*, situated between Pontia and Ischia (Holstenius).



PANDECTS, PANDECTÆ, in jurisprudence, the digest or collection, made by Justinian's order, of 534 decisions or judgments of the ancient lawyers, on so many questions occurring in the civil law; to which that emperor gave the force and authority of law, by the epistle prefixed to them.—The word is Greek, Πανδεκται, compounded of παν "all", and δεχομαι *capio*, "I take;" *i. e.* a compilation, or a book containing all things. Though others, as Bartoli, will have it formed from παν, and δεχομαι; as if these books contained the whole doctrine of the civil law.

The Pandects consist of 50 books, and make the first part of the body of the civil law.

They were denoted by two ππ; but the copyists taking those ππ for *ff*, the custom arose of quoting them by *ff*.

In the year 1137, the Pandects of Justinian, which had been brought by an Amalfitan merchant from the east, fell into the hands of the Pisans. Angelus Politianus believes this copy to be that which had been compiled by order of the emperor. However that be, it is certain that all other copies are taken from it, as being the most ancient. The Pisans having obtained their request from the emperor, carried the volumes to Pisa, and for near three centuries they were known by the name of the *Pandectæ Pisanæ*. But, about the year 1416, Pisa being taken by the Florentines, they were transported from thence to Florence, where they are now preserved in the library of the Medici, and known by the name of the *Pandectæ Florentinæ*. Some authors allege, that Lotharius ordained by an edict that the Pandects should be publicly read and explained at Bologna, and pleaded in the tribunals; but Corringius and Lindenbrogius fully refute their opinion.

Papias extends the denomination of *Pandects* to the Old and New Testament.

There are also PANDECTA *Medicinæ*, "Pandects of Medicine;" a kind of dictionary of things relating to medicine, compiled by Mat. Sylvaticus of Mantua, who lived about the year 1297. Leunclavius has published *Pandects of Turkey*; and Bishop Beveridge, *Pandecta canonum*.

PANDICULATION, a stretching; or that violent and extensive motion of the solids, which usually accompanies the act of yawning.

PANDORA, in fabulous history, a woman formed by Prometheus, to whom each of the gods gave some perfection. Venus bestowed upon her beauty; Pallas, wisdom; Juno, riches; Apollo, music; and Mercury, eloquence: but Jupiter being displeased at Prometheus for having stolen fire from heaven to animate the mass he had formed, gave Pandora a box, which she was ordered not to open; and then sent her to the earth with this box, in which were enclosed age, diseases, pestilence, war, famine, envy, discord, and all the evils and vices that could afflict mankind. This fatal box was opened by Epimetheus, Prometheus's brother, when instantly all the diseases and mischiefs with which

it was filled spread over the earth, and Hope only remained at the bottom. Hesiod says she was the first woman.

PANDOURS, are Hungarian infantry: they wear a loose garment fixed tight to their bodies by a girdle, with great sleeves, and large breeches hanging down to their ancles. They use fire arms, and are excellent marksmen: they have also a kind of sabre near four feet long, which they use with great dexterity.

PANDOSIA (Livy, Justin, Strabo), an inland town of the Bruttii, and a place of strength on the river Acheron, where Alexander of Epirus, deceived by the oracle of Dodona, met his fate and perished. Now *Mendicino* (Holstenius). Another of Epirus (Strabo); situated on the river Acheron (Livy); which Alexander of Epirus was advised to avoid as fatal, but which he met with in Italy. This last is said to have been the residence of the Œnotrian kings, (Strabo).

PANDURA, or PANDORON, a musical instrument, used among the ancients, resembling the lute. The word is said to be formed from the Greek παν and δωρον, i. e. "all gifts, all sorts of gifts." Isidore derives the name from its inventor *Pandorus;* others from *Pan,* to whom they attribute its invention, as well as that of the flute. It has the same number of strings with the lute; but they are of brass, and of consequence give a more agreeable sound than those of the lute. Its frets are of copper, like those of the cistre; its back is flat, like those of the guitar; and the rims of its table, as well as its ribs, are cut in semicircles. Du Cange observes, that Varro, Isidore, and others of the ancients, mention it as having only three strings; whence it is sometimes also spoken of under the denomination τριχορδον, *trichordum.*

PANEAS (Pliny, Josephus): the apparent spring from which the Jordan rises, on the extremity of the west side of the Trachonitis (Pliny).

PANEAS (Coins, Pliny, Josephus), the name of a district adjoining to the spring *Paneas,* with a cognominal town, either enlarged and adorned, or originally built, by Philip son of Herod, and called *Cæsarea* by Josephus; and in St Matthew, *Cæsarea of Philip;* with a temple erected to Augustus his benefactor, who conferred the Trachonitis upon him (Coin). It was afterwards called *Neronias,* in honour of Nero (Josephus).

PANEGYRIC, an oration in praise of some extraordinary thing, person, or virtue.

The name is Greek, πανηγυρις; formed of παν "all," and αγειρω "I assemble;" because anciently held in public and solemn assemblies of the Greeks, either at their games, their feasts, fairs, or religious meetings.

To make their panegyrics the more solemn, the Greeks used to begin with the praises of the deity in whose honour the games, &c. were celebrated; then they descended to the praise of the people or country where they were celebrated; then to the princes or magistrates who presided at them; and at length to the champions, especially the conquerors, who had gained the prizes in them.

PANEGYRICUM, in church history, an ecclesiastical book, used by the Greek church, containing the panegyrical orations of various authors, on the solemnities of Jesus Christ and the saints. It is found in MS. in most churches, but it is not the same in all; each church having its particular saints; and the compilers of this kind of books usually suited their collections to the taste of their own devotion. They are disposed according to the order of the months, and frequently consist of twelve volumes, answering to the twelve months of the year.



Among the principal authors of this work are Athanasius, Cyril, Basil, Chrysostom, &c.

PANEL (*Panella, Panellum*), according to Sir Edward Coke, denotes "a little part;" but the learned Spelman says, that it signifies *schedula vel pagina,* "a schedule or roll;" as a panel of parchment, or a counterpane of an indenture: but it is used more particularly for a schedule or roll, containing the names of such jurors as the sheriff returns to pass upon any trial. And the *impanelling* a jury is the entering their names in a panel or little schedule of parchment.

PANEL, in Scots law, signifies the prisoner at the bar, or person who takes his trial before the court of justiciary for some crime.

PANGOLIN, a species of the manis peculiar to Hindostan. It is certainly a remarkable variety, if not a different species, of the pangolin of Buffon. According to a paper in the first volume of the Asiatic Researches, "it has hardly any neck: and, though some filaments are discernible between the scales, they can scarce be called bristles. But the principal difference is in the tail; that of Buffon's animal being long, and tapering almost to a point; while that of ours is much shorter, ends obtusely, and resembles in form and flexibility the tail of a lobster. In other respects it seems to have all the characters of Buffon's pangolin; a name derived from that by which the animal is distinguished in Java, and consequently preferable to Manis, or Pholidotus, or any other appellation deduced from an European language. We are told that the Malabar name of this animal is *alungu.* The natives of Bahar call it *bajur cit,* or, as they explain the word, *stone vermine;* and in the stomach of the animal before us was found about a teacupful of small stones, which had probably been swallowed for the purpose of facilitating digestion; but the name alludes, we believe, to the hardness of the scales: for *vajracita* means in Sanscrit the *diamond* or *thunderbolt reptile;* and *vajira* is a common figure in the Indian poetry for any thing excessively hard. The vajracita is believed by the Pundits to be the animal which gnaws their sacred stone called *salgramasila:* but the pangolin has apparently no teeth: and the salgrams, many of which look as if they had been worm-eaten, are perhaps only decayed in part by exposure to the air.

Plate CCCLXXIV.

"A female pangolin, described in the first volume of the Asiatic Researches, had a long tongue shaped like that of the chameleon; and if it was nearly adult, as we may reasonably conclude from the young found in it, the dimensions of it were much less than those which Buffon assigns generally to his pangolin; for he describes its length as six, seven, or eight feet, including the tail, which is almost, he says, as long as the body, when it has attained its full growth: whereas ours is but 34 inches long from the extremity of the tail to the point of the snout, and the length of the tail is 14 inches; but, exclusively of the head, which is five inches long, the tail and body are indeed nearly of the same length; and the small difference between them may show, if Buffon

Buffon be correct in this point, that the animal was young. The circumference of its body in the thickest part is 20 inches, and that of the tail only 12. There are on each foot five claws, of which the outer and inner are small when compared with the other three. There are no distinct toes; but each nail is moveable by a joint at its root. This creature is extremely inoffensive. It has no teeth, and its feet are unable to grasp. Hence it would appear, that nature, having furnished it with a coat of mail for its protection, has, with some regard to justice, denied it the powers of acting with hostility against its fellow creatures. The nails are well adapted for digging in the ground; and the animal is so dexterous in eluding its enemies by concealing itself in holes and among rocks, that it is extremely difficult to procure one.

"The upper jaw is covered with a cross cartilaginous ridge, which, though apparently not at all suited to any purposes of mastication, may, by increasing the surface of the palate, extend the sense of taste. The œsophagus will admit a man's forefinger with ease. The tongue at the bottom of the mouth is nearly about the size of the little finger, from whence it tapers to a point. The animal at pleasure protrudes this member a great way from the mouth. The tongue arises from the ensiform cartilage and the contiguous muscles of the belly, and passes in form of a round distinct muscle from over the stomach, through the thorax, immediately under the sternum; and interior to the windpipe in the throat. When dissected out, the tongue could be easily elongated so as to reach more than the length of the animal exclusive of its tail. There is a cluster of salivary glands seated around the tongue, as it enters the mouth. These will necessarily be compressed by the action of the tongue; so as occasionally to supply a plentiful flow of their secretion.

"The stomach is cartilaginous, and analogous to that of the gallinaceous tribe of birds. When dissected, it is generally found full of small stones and gravel, which in India are almost universally calcareous. The inner surface of the stomach is rough to the feel, and formed into folds, the interstices of which are filled with a frothy secretion. The guts are filled with a sandy pulp, in which, however, are interspersed a few distinct small stones. No vestiges of any animal or vegetable food have been traced in the whole primæ viæ. The gall bladder is commonly distended with a fluid resembling in colour and consistence the dregs of beer. It is a viviparous animal.

"From the contents of its stomach and primæ viæ, the pangolin has been supposed by Mr Burt, a very eminent surgeon in Bengal, to derive its nourishment from mineral substances. Tho' we have perhaps no clear idea of the manner in which vegetables extract their nourishment from earth, yet the fact being so, it may not be unreasonable to suppose, that some animal may derive nutriment by a process somewhat similar.

"When other substances (says our author) shall have been detected in the stomach of this animal, my inference, from what I have seen, must necessarily fall to the ground. But if, like other animals with muscular and cartilaginous stomachs, this singular quadruped consumes grain, it must be surprising that no vestige of such food was found present in the whole alimentary canal, since in that thinly inhabited country, the wild animals are free to feed without intrusion from man. Nor can it be inferred from the structure of the stomach, that this animal lives on ants or on insects. Animals devoured as food, though of considerable size and solidity, with a proportionally small extent of surface to be acted on by the gastric juice and the action of the stomach, are readily dissolved and digested by animals possessing not a cartilaginous but a membranaceous stomach, as, for instance, a frog in that of a snake.



"In the stomach many minerals are soluble, and the most active things which we can swallow. Calcareous substances are readily acted on. Dr Priestley has asked, 'May not phlogistic matter be the most essential part of the food and support of both vegetable and animal bodies?' I confess, that Dr Priestley's finding cause to propose the question, inclines me to suppose, that the affirmative to it may be true. Earth seems to be the basis of all animal matter. The growth of the bones must be attended with a constant supply, and in the human species there is a copious discharge of calcareous matter thrown out by the kidneys and salivary glands. May not the quadruped in question derive phlogiston from earth; salt, from mineral substances? And, as it is not deprived of the power of drinking water, what else is necessary to the subsistence of his corporeal machine?

"Considering the scaly covering of this animal, we may conceive, that it may be at least necessary for its existence, on that account, to imbibe a greater proportion of earth than is necessary to other animals. It may deserve consideration, that birds are covered with feathers, which, in their constituent principles, approach to the nature of horn and bone. Of these animals, the gallinaceous tribe swallow stones; and the carnivorous take in the feathers and bones of their prey: the latter article is known to be soluble in the membranaceous stomachs; and hence is a copious supply of the earthy principles. In truth I do not know that any thing is soluble in the stomach of animals, which may not be thence absorbed into their circulating system; and nothing can be so absorbed without affecting the whole constitution. These conjectures are not a little confirmed by the experiments of M. Bruquatelli of Pavia, on the authority of M. Crell, by which we learn, that some birds have so great a dissolvent power in the gastric juice, as to dissolve in their stomachs flints, rock crystal, calcareous stones, and shells." See Manis.

PANGONIA, in natural history, the name of a genus of crystals, consisting of such as are composed of many angles. The word is derived from *πας numerous*, and *γωνυ an angle* or *bending*. The bodies of this genus are single-pointed or imperfect crystals, composed of dodecangular or twelve-planed columns, terminated by twelve-planed pyramids, and the whole body therefore made up of twenty-four planes. Of this genus there are only three known species.

PANIC, denotes an ill-grounded terror or fright. Polyænus says, it originates from *Pan*, one of the captains of Bacchus, who with a few men put a numerous enemy to rout, by a noise which his soldiers raised in a rocky valley, favoured with a great number of echoes. This stratagem making their number appear far greater than it was, the enemy quitted a very commodious

encampment,

encampment, and fle... Hence all ill-grounded fears have been called *panics*, or *panic fears*; and it was this that gave occasion to the fable of the nymph Echo's being beloved by the god Pan. Others derive the origin of it hence: that in the wars of the Titans against the gods, Pan was the first who struck terror into the hearts of the giants. Theon on Aratus says, he did it by the means of a sea shell, which served him for a trumpet, whereof he was the inventor.

PANICLE, in botany, denotes a soft woolly beard, on which the seeds of some plants hang pendulous; as in millet, reeds, and hay.

PANICUM, in botany; a genus of the digynia order, belonging to the triandria class of plants. The calyx is trivalved; the third valvule being very small.

The *species* are, 1. Polystachion; 2. Verticillatum; 3. Glaucum; 4. Viride; 5. Italicum; 6. Crus corvi; 7. Crus galli; 8. Coronum; 9. Brisoides; 10. Dimidiatum; 11. Hirtellum; 12. Conglomeratum; 13 Sanguinale; 14. Dactylon; 15. Filiforme; 16. Lineare; 17. Distachion; 18. Elatum; 19. Compositum; 20. Halvoium; 21. Dichotomum; 22. Ramosum; 23. Coloratum; 24. Repens; 25. Miliaceum; 26. Capillare; 27. Grossarium; 28. Latifolium; 29. Clandestinum; 30. Arborescens; 31. Curvatum; 32. Virgatum; 33. Patens; 34. Brevifolium; 35. Divaricatum.

At this place it is proper to take notice of the Guinea grass. By some authors it is classed as a panicum; but by expert botanists, who have lately examined the plant, it is the *holcus polygamum*. It is a native of Africa, and brought from thence to the West Indies. About 70 years ago Mr John Ellis got some birds from the coast of Guinea, and with them some seeds for their support: The birds dying soon after, the seeds were thrown out of doors as useless. From these seeds a new luxuriant grass sprung up, which attracted the notice of Mr Ellis and his family. He had a horse, and afterwards a cow, brought where it was; both of them eat of it greedily. It was then transplanted into a garden, and gradually cultivated: at this day it is common all over Jamaica; and next to the sugar cane and plantain tree, the greatest blessing to that island. It agrees with every soil and situation; and in many of the rocky and barren parts of Jamaica, which formerly could not support a goat, may now be seen large herds of cattle, sheep, and horses, in excellent order, and fitted for all the purposes of rural economy or the market. Since Guinea grass became so common, salted beef and pork is but little used by the white people in Jamaica. Fresh beef, mutton, pork, and poultry, are in abundance; and on the whole cheaper than salted meats from Ireland or America: By these means, too, people live better, and enjoy as good health as others in Europe.

Guinea grass is best propagated by the roots, and planted about three feet asunder. In six months it grows very tall, so as often to be six feet high. At this time horses and cattle are turned in to eat what they please of it; and while they plough up the surface of the ground with their feet, they shake the ripe seed. The rank grass is afterwards cut down, burned off, and the old stocks rooted up and thrown away. The seeds vegetate and throw up a plentiful crop; which with common attention will last many years. For this purpose a Guinea grass pasture requires to be kept clean, and supplied in particular places as may be necessary from time to time. The fields ought to be divided into parks by fences, and the cattle shifted from one enclosure to another occasionally.



PANINI (Paolo), a painter of perspective and architecture. He was born at Placentia in 1691, with a most happy genius to painting, which he cultivated by studying at Rome, where he designed every vestige of ancient magnificence, the ruins of superb Roman edifices, cenotaphs, columns, baths, arches, and obelisks, as also some of the most entire buildings, the ornaments of modern Rome.

He studied the works of Ghisolsi with peculiar pleasure; he formed his taste, style, and manner, by the compositions of that esteemed artist; and his strongest ambition was to imitate him; so that he soon became eminent in that style beyond all his cotemporaries. His composition is rich; the truth of his perspective is critically exact; and his paintings are universally esteemed for the grandeur of the architecture, for the clearness of his colouring, for the beautiful figures which he generally introduced, and also for the elegant taste with which he disposed them. He always designed them correctly, and set them off with suitable attitudes and expression.

However, this description of his merit must be supposed to allude to his early and prime performances; for in his latter time, his pictures were distinguishable by a free and broad touch, but they are feeble in their colouring and effect. At all times, indeed, he was too apt to design his figures rather too large for the architecture, which diminished the grandeur of the most magnificent parts of his composition, and was quite contrary to the practice of Ghisolsi; whose works must perpetually afford a pleasing deception to the eye, by the perspective proportions observed between the figures, buildings, and distances.

At Rivoli, a pleasure house belonging to the king of Sardinia, there are several of Panini's paintings, which are views of that fine retreat and its environs. They are beautifully coloured, well handled, and with a touch full of spirit; though in some parts the yellow seems a little too predominant, and the lights are not always distributed in such a manner as to produce the most striking effect.

PANIONIA, in antiquity, a festival celebrated in honour of Neptune by a concourse of people from all the cities of Ionia. It is remarkable in this festival, that if the bull offered in sacrifice happened to bellow, it was accounted an omen of divine favour; because that sound was thought to be acceptable to Neptune.

PANNARIA, one of the Lipari islands. See LIPARA and LIPARI.—The ancients called it *Thernisia*, from the hot waters which they found in it. It may be about eight or nine miles in circumference. It bears wheat, and grapes from which the inhabitants make wine. Pannaria, like the other adjacent islands, appears to be a volcano; its original having been destroyed by continued eruptions. It is now no longer of a conical figure. It contains about 100 inhabitants, reckoning every soul, men, women, and children. It is, like Stromboli, governed by a curate, who depends on the priest of the parish of St Joseph in Lipari; and when

Pannaria. when any couple in the island determine to marry, they must cross the sea to Lipari to receive the nuptial benediction in the parish of St Joseph, or pay a sum for a license to empower the curate of Pannaria to perform the ceremony. All the other adjoining islands are subject to the same regulation.

The inhabitants of Pannaria live by fishing, and by taking small quantities of game on this and the little contiguous islands. They bring up and tame those birds known by the name of *gulls*, which are seen in tempestuous weather flying near the surface of the sea, They are here called *corracio*. The body of the bird and the tips of its wings are white; but the head, the tail, and the rest of the wings, are gray: they are of the size of Indian hens; their wings are prodigiously large: they have their nests on the steep inaccessible cliffs of the several islands. When the islanders bring these birds up tame, they feed them with fish, which, though of such size that you would think it impossible for their stomachs to receive them, they eagerly stretch their necks and swallow rapaciously. These birds are thus brought up to be as tame as pullets or pigeons; and such an attachment do they often acquire to the places in which they are reared, that some of them have been known to return to these islands after being conveyed to Mellazzo and Messina.

On the summit of a hill in this island, which projects over the sea, the inhabitants pretend to show a castle and an inscription. But their castle is only an elevated peak of the rock, which nature seems to have prepared as a retreat for birds. It consists of puzzolana; and has been actually formed by the action of winds and rains, for a long course of time, into a fantastic figure, which may appear, when carelessly viewed from a distance by an undistinguishing eye, the remains of some ancient structure. The good people of the island, not being able to judge of it otherwise than from appearance, are persuaded, that it can be nothing but a castle, which must have been reared for the defence of the island aganst the Turks and the corsairs of Barbary. These they consider as the most dreadful scourge with which mankind can possibly be afflicted, and fear them much more than the eruptions of the volcano. When they feel their island shaken, they embark with all their wealth, which a single sloop easily contains; and on board they are safe from both the shaking of the earth and the eruptions of the lava, but not from an hostile fleet.

In this island there appear various remains of ancient buildings, but very ruinous and very scanty. In ploughing the fields, many remains of sepulchres, in different modes of construction, are found; some of rough stones, tiles, or bricks; others consisting each of a single stone. Vases of various sorts and sizes are also said to have been found in the same fields, utensils of different kinds, money, chains, and medals of lead. But none of these relicks of antiquity have been preserved: the good people who found them were ignorant of their value, and therefore neglected them as trifles. In places along the shore of the island, where the sea appears to have encroached, there are some hewn stones to be seen: they seem to be remains of walls, which must have been very strong and of elegant architecture. In other places farther distant from the shore, there likewise appear fragments of walls sunk in the ground, and apparently overwhelmed with mud, which the winds and rains have brought down from the mountain above. These remains show, that Pannaria, either under the Greeks, or in that period when all the elements were taxed for the gratification of Roman luxury, must have been adorned with superb buildings, as well as the adjacent islands of Lipari, Stromboli, and Basiluzzo.

Pannels || Panorpa.

PANNELS *of a* SADDLE, are two cushions or bolsters, filled with cows, deer, or horses hair, and placed under the saddle, on each side, to prevent the bows and bands from galling the horse.

PANNICULUS CARNOSUS, in comparative anatomy, a robust fleshy tunic, situated in beasts between the skin and the fat; by means of which they can move their skin in whole or in part. It is altogether wanting in mankind.

PANNONIA (Pliny, Strabo, Dio), an extensive country of Europe, having the Danube on the north, Dalmatia on the south, Noricum on the west, and Moesia on the east. It is divided into *Superior* and *Inferior* (Ptolemy, Dio). The common boundary between both were the river Arabo and Mount Cetius, having the Superior to the west, and the Inferior on the east side. This division is thought to be no older than the times of the Antonines. *Pannonicus* the epithet (Martial).

PANOMPHÆUS, in antiquity, a designation given to Jupiter, because he was said to be the original author of all sorts of divination, having the books of fate, and out of them revealing either more or less, as he pleased, to inferior demons.

PANOPOLIS. See ACHMIM.

PANORMUS (Polybius, Pausanias), a town of Achaia, in Peloponnesus, near the promontory Rhium. —Another (Ptolemy, Pliny), a town on the north side of Crete.—A third (Ptolemy), in Macedonia, on the Ægean sea, near Mount Athos.—A fourth, of Samos (Livy.)—A fifth, of Sicily; an ancient city, built by the Phœnicians (Thucydides); a principal town of the Carthaginians (Polybius); situated between Lilybæus and Pelorus (Mela); a Roman colony. Now *Palermo*, capital of the island, on the north side. E. Long. 13. N. Lat. 38. 30.—A sixth Panormus of the Thracian Chersonesus, placed by Pliny on the west side of the peninsula, and mentioned by no other writer.

PANORMUS (Ptolemy), a port of Attica; its name denoting it to be capacious.—Another, of Epirus (Strabo, Ptolemy); a large harbour in the heart of the Montes Ceraunii, below the citadel Chimæra.—A third of Ionia (Strabo); near Ephesus, with the temple of the Ephesian Diana.

PANORPA, the SCORPION FLY, in zoology, a genus of insects belonging to the order of neuroptera. The rostrum is horny and cylindrical; there are two pappi, and three stemmata; the feelers are longer than the thorax. The body of this insect is of a black brown colour, yellow on the sides, with a few spots of the same on the top. Its tail, formed by the three last segments of the abdomen, is of a maroon colour; of those three segments, the last is larger, almost round, and terminates in two hooks, which constitutes a tail like that of the scorpion. The wings as long as the body, are diaphanous, reticulated, with fibres and stripes of spots of a brown colour. Sometimes we meet with different varieties of this insect, consisting in the colour of

Plate CCCLXXII. *Barbut on Insects.*

of the wings. Some, instead of several stripes of spots upon their wings, have only a single black stripe, transverse and irregular, situated on the middle of the wing, the extremity whereof is also black: others have their wings entirely white, excepting the extremity, which is black. The kind of forceps that is seen at the hinder part of this insect is used by the males to lay hold of the females in their amorous embraces: the threatening tail of the male does no mischief. This insect is found in meadows, by the side of ditches. There are four species, distinguished by the colour and shape of their wings.

PANTALARIA, an island in the Mediterranean sea, between Sicily and the main land of Africa, about 17 miles in circumference. It is near the coast of Tunis, and abounds in cotton, fruits, and wine; but the inhabitants are obliged to bring all their corn to Sicily, as it belongs to the king of the two Sicilies. E. Long. 12. 25. N. Lat. 36. 55.

PANTÆNUS, a Stoic philosopher, born in Sicily (though some have erroneously supposed him to be a Hebrew) about the beginning of the reign of Commodus. He presided over the celebrated school of Alexandria, where, from the time of St Mark, the founder of that church, they had always a divine that was eminent for his learning and piety, to explain the Holy Scriptures, and to instruct them in human learning. This employment he was obliged to leave; for when the Indians required of Demetrius bishop of Alexandria to send them one to instruct them in Christianity, he sent Pantænus, who undertook the mission with joy, and behaved himself very properly in it. We are told, that the Indians had been tinctured with Christianity by St Bartholomew the apostle; and that Pantænus met with the Hebrew original of St Matthew's gospel, which the apostle had left there. St Jerome says that Pantænus brought it with him; and that it was, in his time, preserved in the library of Alexandria. But we suspect St Jerome to be mistaken in this respect. When Pantænus returned to Alexandria, he reassumed the government of the school of that city, which, it is probable, he had, during his absence, committed to the care of St Clement, a presbyter of Alexandria. He explained the Scriptures publicly, under the reign of Severus Antoninus Caracalla; and was, in St Jerome's opinion, more serviceable to the church by his discourses than by his writings. He published some commentaries upon the Bible, which are lost. "That the prophets often express themselves in indifferent terms, and that they make use of the present time instead of the past and future," is a rule of Pantænus, which has been followed by all succeeding interpreters. Theodorus has related this rule; but he speaks of it as if Pantænus had rather said than written it.

We may have some notion of Pantænus's manner of explaining the Scriptures by the like performances of St Clement of Alexandria, Origen, and others who were brought up in that school.

PANTALOON, a sort of garment consisting of breeches and stockings all of one piece; said to have been first introduced by the Venetians.

**Pantaloon**, on the theatre, is a buffoon or masked person, who performs high and grotesque dances, and shows violent and extravagant postures and airs. The word is likewise used for the habit or dress these buffoons usually wear; which is made precisely to the form of their body, and all of a piece from head to foot.

And hence those who wear a habit of this kind, for conveniency, under their other clothes, are called *pantaloons* of Venice.

PANTARBE, in natural history, a name given to an imaginary stone, the effects of which upon gold were similar to those of the loadstone upon iron. The ancients, as well as some modern writers, seem to have had an opinion that there was such a stone; and the *amphitane* of Pliny is described as possessing this remarkable quality; but neither they nor we have ever found reason, from any experiment well ascertained, to believe that there ever was such a stone.

PANTHEA, in antiquity, were single statues, composed of the figures, or symbols, of several different divinities together. Father Joubert, who calls them *pantheæ*, and who has remarked them sometimes on medals, says their heads are most commonly adorned with the symbols or attributes belonging to several gods. An instance of this appears in a medal of Antoninus Pius; which represents Serapis by the bushel it bears; the Sun by the crown of rays; Jupiter Ammon by the ram's horns; Pluto by the large beard; and Æsculapius by the serpent twisted in his hand. M. Baudelot, in a dissertation on the Lares, observes, that the *panthea* had their origin from the superstition of those, who, taking several gods for the protectors of their houses, united them all in the same statue, by adorning it with the several symbols proper to each of these deities.

PANTHEISM, a philosophical species of idolatry leading to atheism, in which the universe was considered as the supreme God. Who was the inventor of this absurd system, is, perhaps, not known; but it was of early origin, and differently modified by different philosophers. Some held the universe to be one immense animal, of which the incorporeal soul was properly their God, and the heavens and earth the body of that God; whilst others held but one substance, partly active and partly passive; and therefore looked upon the visible universe as the only *Numen*. The earliest Grecian Pantheist of whom we read was Orpheus, who called the world *the body of God*, and its several parts *his members*, making the whole universe one *divine animal*. According to Cudworth, Orpheus and his followers believed in the immaterial soul of the world; therein agreeing with Aristotle, who certainly held that God and matter are coeternal; and that there is some such union between them as subsists between the souls and bodies of men. See Metaphysics, N° 264.

In the ancient Orphic theology, we are taught, that "this universe, and all things belonging to it, were made *within* God; that all things are contained together in the *womb* of God; that God is the *head* and *middle* of all things; that he is the *basis* of the *earth* and *heaven*; that he is the *depth of the sea*, the *air* we breathe, the force of the untameable *fire*; that he is the *sun*, *moon*, and *stars*; that there is one divine *body*; for,

Παντα γαρ εν μεγαλω ταδε σωματι κειται

"all these things lie in the great body of God."—But further, to prove that the most ancient Greek philosophers

 solved resolved all things into God, and made God *all*, we shall cite a most remarkable passage from Plutarch's Defect of Oracles. "Whereas there are two causes of all generations, the divine and the human, the most ancient theologers and poets attended only to the more excellent of these two; resolving all things into God, and pronouncing this of them universally;

Ζευς αρχη, Ζευς μεσσα, Διος δ' εκ παντα πελονται.

'that God is both the beginning and middle, and that all things are out of God; insomuch, that they had no regard at all to the other natural and necessary causes of things: but on the contrary, their juniors, who were called *naturalists*, deviating from this most excellent and divine principle, placed in all *bodies*, their passions, collisions, mutations, and commixtures."

That by the most ancient theologers here mentioned, Plutarch meant Orpheus and his immediate followers, is plain from the Orphic verse by which he proves their antiquity. By their juniors, whom he calls *naturalists*, he could mean no other than the first Grecian philosophers, *Anaximander*, *Anaximenes*, and *Hippo*, who were followed by the atheistical atomists *Leucippus*, *Democritus*, *Protagoras*, and *Epicurus*. But with respect to the universe being God, and all things divine and human being modifications of mere matter, the Stoics undoubtedly agreed with Anaximander and his followers; for the school of Zeno held but one substance.— See METAPHYSICS, N° 265. This impious doctrine, that all things are God, and that there is but one substance, was revived in modern times by Spinoza, an apostate Jew. As we shall give a life of him and a view of his principles, we must refer the reader for a fuller account of Pantheism to SPINOZA. See also PAN.

PANTHEON, a beautiful edifice at Rome, anciently a temple, dedicated to all the gods; but now converted into a church, and dedicated to the Virgin and all the martyrs.

This edifice is generally thought to have been built by Agrippa son-in-law to Augustus, because it has the following inscription on the frieze of the portico:

M. AGRIPPA L. F. COS. TERTIUM FECIT.

Several antiquarians and artists, however, have supposed that the pantheon existed in the times of the commonwealth; and that it was only embellished by Agrippa, who added the portico. Be this as it will, however, the pantheon, when perfected by Agrippa, was an exceedingly magnificent building; the form of whose body is round or cylindrical, and its roof or dome is spherical: it is 144 feet diameter within; and the height of it, from the pavement to the grand aperture on its top, through which it receives the light, is just as much. It is of the Corinthian order. The inner circumference is divided into seven grand niches, wrought in the thickness of the wall: six of which are flat at the top; but the seventh, opposite to the entrance, is arched. Before each niche are two columns of antique yellow marble fluted, and of one entire block, making in all 14, the finest in Rome. The whole wall of the temple, as high as the grand cornice inclusive, is cased with divers sorts of precious marble in compartments. The frieze is entirely of porphyry. Above the grand cornice arises an attic, in which are wrought, at equal distances, 14 oblong square niches: between each niche were four marble pilasters, and between the pilasters marble tables of various kinds. This attic had a complete entablature; but the cornice projected less than that of the grand order below. Immediately from the cornice springs the spherical roof, divided by bands, which cross each other like the meridians and parallels of an artificial terrestrial globe. The spaces between the bands decrease in size as they approach the top of the roof; to which, however, they do not reach, there being a considerable plain space between them and the great opening. That so bold a roof might be as light as possible, the architect formed the substance of the spaces between the bands of nothing but lime and pumice stones. The walls below were decorated with lead and brass, and works of carved silver over them; and the roof was covered on the outside with plates of gilded bronze. There was an ascent from the springing of the roof to the very summit by a flight of seven stairs. And if certain authors may be credited, these stairs were ornamented with pedestrian statues ranged as an amphitheatre. This notion was founded on a passage of Pliny, who says, "That Diogenes the sculptor decorated the pantheon of Agrippa with elegant statues; yet that it was difficult to judge of their merit, upon account of their elevated situation." The portico is composed of 16 columns of granite, four feet in diameter, eight of which stand in front, with an equal intercolumniation all along, contrary to the rule of Vitruvius, who is for having the space answering to the door of a temple, wider than the rest. Of these columns is a pediment, whose tympanum, or flat, was ornamented with bas-reliefs in brass; the cross beams which formed the ceiling of the portico were covered with the same metal, and so were the doors. The ascent up to the portico was by eight or nine steps.

Such was the pantheon, the richness of which induced Pliny to rank it among the wonders of the world.

The eruption of Vesuvius, in the reign of Tiberius, damaged the pantheon very considerably: it was repaired by Domitian; which occasioned some writers to mention that prince as the founder of the building.— The emperor Adrian also did something to it. But it appears, that the pantheon is more indebted to Septimius Severus, than to any one since its erection. The most, perhaps, that any of his predecessors had done, was the adding some ornament to it: Septimius bestowed essential reparations upon it. The following inscription appears upon the architrave:

IMP. CAES. SEPTIMIVS. SEVERVS.
PIVS. PERTINAX.
ARABICVS. PARTHICVS. PONTIF.
MAX. TRIB. POT.
XI. COS. III. P. P. ET. IMP. CAES.
MARCVS.
AVRELIVS. ANTONINVS. PIVS.
FELIX. AVG. TRIB.
POT. V. COS. PROCOS. PANTHEVM.
VETVSTATE.
OBRVPTVM. CVM. OMNI. CVLTV.
RESTITVERVNT.

It is really a matter of astonishment, that a structure, which, granting it to have been built by Agrippa, was not more than 200 years old, should have fallen into decay through age. This single consideration seems sufficient to confirm the opinion of those who

who believe it to have ftood in the time of the commonwealth.

The temple fubfifted in all its grandeur till the incurfion of Alaric in the time of Honorius. Zofimus relates, that the Romans having engaged to furnifh this barbarian prince with 3000 pounds weight of gold and 5000 pounds weight of filver, upon condition that he fhould depart from their walls; and it proving impoffible to raife thofe fums either out of the public treafury or private purfes, they were obliged to ftrip the temples of their ftatues and ornaments of gold and filver. It is probable that the pantheon fupplied a good part, as that of Jupiter Capitolinus was the only one in Rome that could vie with it for riches.

Alaric carried off nothing from the Romans befides their precious metals. Thirty-nine years after this, Genferic king of the Vandals took away part of their marbles; and whether from a greedinefs of plunder, or from a relifh of the productions of art, loaded one of his fhips with ftatues. It cannot be queftioned, but that on this occafion the pantheon was forced to part with more of its ornaments, and that the ineftimable works of Diogenes became the prey of this barbarian.

Before thefe unwelcome vifits of the Goths and Vandals, the Chriftian emperors had iffued edicts for demolifhing the Pagan temples. But the Romans, whatever were their motives, fpared the pantheon, which is known to have fuffered no damage from the zeal of the pontiffs, or the indignation of the faints, before the firft fiege of Rome by Alaric. It remained fo rich till about the year 655, as to excite the avarice of Conftantine II. who came from Conftantinople to pillage the pantheon, and executed his purpofe fo far as to ftrip it both of its infide and outfide brazen coverings, which he tranfported to Syracufe, where they foon after fell into the hands of the Saracens.

About fifty years before this, Pope Boniface IV. had obtained the pantheon of the emperor Phocas, to make a church of it. The artifts of thefe days were totally ignorant of the excellence of the Greek and Roman architecture, and fpoiled every thing they laid their hands upon. To this period certain alterations are to be referred, of which we fhall fpeak by and by.

After the devaftations of the barbarians, Rome was contracted within a narrow compafs: the feven hills were abandoned; and the Campus Martius, being an even plain, and near the Tyber, became the groundplat of the whole city. The pantheon happening to ftand at the entrance of the Campus Martius, was prefently furrounded with houfes, which fpoiled the fine profpect of it; and it was yet more deplorably difgraced by fome of them which ftood clofe to its walls. Pedlars fhades were built even within its portico, and the intercolumniations were bricked up, to the irreparable damage of the matchlefs pillars, of which fome loft part of their capitals, fome of their bafes, and others were chiffeled out fix or feven inches deep, and as many feet high, to let in pofts. Which excavations are to this day half filled up with brick and mortar; a fad monument of the licentioufnefs of the vulgar, and of the ftupid avarice of thofe who fold them the privilege to ruin the nobleft piece of art in the world!

This diforder continued till the pontificate of Eugene IV. whofe zeal for the decency of a confecrated place, prevailed upon him to have all the houfes cleared away that encumbered the pantheon, and fo the miferable barracks in the portico were knocked down.



From the time Conftantius carried off the brafs plating of the external roof, that part was expofed to the injuries of the weather, or at beft was but flightly tiled in, till Benedict II. covered it with lead, which Nicholas V. renewed in a better ftyle.

It does not appear that from this time to Urban VIII. any pope did any thing remarkable to the pantheon.

Raphael Urban, who had no equal as a painter, and who as an architect had no fuperior, left a confiderable fum by his will for the reparation of the pantheon, where his tomb is placed. Perino de la Vagua, Jacomo Udino, Hannibal Carracci, Flamingo Vacca, and the celebrated Archangelo Corelli, did the fame. All the ornaments within, that have any claim to be called good, are of the later times; the paintings merit efteem; and the ftatues, though not mafterpieces, do honour to fculpture, which alone is a proof that they are pofterior to the 15th century.

But, with all the refpect due to a pontiff, who was otherwife a protector, and even a practifer of the arts, it were much to be wifhed that Urban VIII. had not known that the pantheon exifted. The infcriptions cut at the fide of the door inform us, that he repaired it; yet, at the fame time that he built up with one hand, he pulled down with the other. He caufed two belfreys of a wretched tafte to be erected on the ancient front work, and he diverted the portico of all the remains of its ancient grandeur, viz. the brazen coverture of the crofs beams, which amounted to fuch a prodigious quantity, that not only the vaft baldaquin or canopy of the confeffional in St Peter's was caft out of it, but likewife a great number of cannon for the caftle of St Angelo. This pope, who was of the family of Barbarini, prefented alfo as much of this metal to his nephew, as was fufficient for the decoration of his new palace; on which occafion this remarkable pafquinade was ftuck up:

*Quod non fecerunt Barbari fecere Barbarini.*

If ever gingle added force to wit, it was certainly in this inftance.

It is furprifing, that whilft all thefe operations were carrying on in the portico, he never once thought of repairing the damages which time had wrought in it! Of the 16 pillars which fupported this magnificent pile, there were no more than 13 left; the three next the temple of Minerva had difappeared; with thefe the entablature and an angle of the front had tumbled down. There were not wanting in Rome fragments enough of antique columns that might have been put together, and fet up, to have prevented the downfal of a pile which deferved to ftand as long as the world endured.

Alexander VII. did what Urban VIII. had neglected to do. At the fame time that Bernini was conftructing the colonnade of St Peter, this pontiff ordered fearch to be made for pillars to match thofe of the portico of the pantheon; and fome were found not far from the French church of St Lewis of the very fame model. They were granite of the ifle of Ilva, and thofe

those of the portico were Egyptian granite; the colour however, was the same, so that the effect was equal. The pope's zeal did not stop here; he caused all the old houses before the portico to be pulled down, and the soil and rubbish to be cleared away which covered the steps, and even the bases of some of the pillars. He began covering the roof with marble, and raised a lantern over the aperture, to keep out rain; but death took him off before his project was completed. Clement IX. his successor, enclosed the portico within iron rails. Several later popes have added to its decorations, which were all in the taste of the times they were done in; and the body of the edifice and its architecture gained nothing from them. The main object of their holinesses liberality was the embellishment of the grand altar. One gave purple curtains, another bestowed silver tabernacles; others again vases, and superb dresses suited to the solemn ceremonies of religion. All these might be called rich: but they had in no sense a tendency to retrieve the ancient majesty or original splendour of the temple. The true gusto of the ornaments was a little imitated at the revival of the arts. Good statues took place of the skeletons and squat figures that ridiculously disgraced the altars for the space of eight centuries. The paintings of Perugino, Cozza, and Gressi, covered the dull mosaics with which the Greeks of Constantinople had loaded the walls of most of the churches in Rome. The porphyry and the green and yellow antique found among the old ruins were employed to much advantage.

There was besides at Rome another pantheon, dedicated to Minerva as the goddess of Medicine. It was in the form of a decagon, and the distance from one angle to another measured about 22 feet and a half. Between the angles there were nine round chapels, each of which was designed for a deity; and over the gate there was a statue of Minerva. The pantheon of Athens was in many respects little inferior to the Roman one built by Agrippa. The Greek Christians also converted it into a church, dedicated it to the Virgin, under the name of *Panagia*; and the Turks changed it into a mosque. The pantheon of Nismes was a temple in that city, wherein were 12 niches or statues, supposed to have been destined for the 12 great gods. In the Escurial is a most magnificent chapel called *pantheon*, 35 feet in diameter, and 38 feet high from the pavement, which is composed of marble and jasper inlaid. The whole inside of the chapel is of black marble, except the luthern, and some ornaments of jasper and red marble. In this chapel are deposited the bodies of the kings and queens; there are only places for 26, and eight of them are already filled.

PANTHER, in zoology. See FELIS.

PANTING, consists in a rapid succession of inspirations and expirations, which happens when we run or perform any violent motion.



PANTOMINE, Παντομιμος, among the ancients, a person who could imitate all kind of actions and characters by signs and gestures, without speaking.

The pantomimes made a part in the theatrical entertainments of the ancients; their chief employment was to express, in gestures and action, whatever the chorus sung, changing their countenance and behaviour as the subject of the song varied. They were very ancient in Greece, being derived from the heroic times, according to some; but however this may be, they were certainly known in Plato's time. In Rome, it was so late as the time of Augustus before they made their appearance. As to their dress, it was various, being always suited as near as possible to that of the person they were to imitate. The crocota was much used among the Roman pantomimes, in which and other females dresses they personated women.

We have this account of them in Gibbon's history; "The pantomimes (A), who maintained their reputation from the age of Augustus to the sixth century, expressed, without the use of words, the various fables of the gods and heroes of antiquity; and the perfection of their art, which sometimes disarmed the gravity of the philosopher, always excited the applause and wonder of the people. The vast and magnificent theatres of Rome were filled by 3000 female dancers, and by 3000 singers with the masters of the respective chorusses. Such was the popular favour which they enjoyed, that in a time of scarcity, when all strangers were banished from the city, the merit of contributing to the public pleasures exempted them from a law which was strictly executed against the professors of the liberal arts (B)."

Pantomimes are still very common in England: they differ indeed in some respects from those of antiquity; but they retain the name, and like these they consist in in the representations of things merely by gestures.

PANUCO, a town and province of North America, in New Spain, lying to the north of Mexico, with a bishop's see. There are veins of gold, and salt works, which are the principal revenue of the inhabitants.—It is seated near the mouth of a river of the same name, at a small distance from the gulf of Mexico. W. Long. 100. 5. N. Lat. 24. 0.

PANZACCHIA (Maria Helena). This paintress was born at Bologna in 1668, of a noble family, and appeared to have an extraordinary genius for painting. She learned design under the direction of Emilio Taruffi, and in a short space of time made an astonishing proficiency so that in the compass of a few years she acquired great readiness in composition, correctness of outline, and a lively tint of colouring.

She also excelled in painting landscapes; and by the



(A) "See the dialogue of Lucian, entitled, *De Saltatione*, Tom. II. p. 265—317. edit. Reitz. The pantomimes obtained the honourable name of χειροσοφοι; and it was required that they should be conversant with almost every art and science. Burette (in the *Memoires de l'Academie des Inscriptions*, Tom. I. p. 127, &c.) has given a short history of the art of pantomimes.

(B) "Ammianus, l. xiv. c. 6. He complains with decent indignation, that the streets of Rome were filled with crowds of females who might have given children to the state, but whose only occupation was to curl and dress their hair; and *jactari volubilibus gyris, dum exprimunt innumera simulacra, quæ finxere fabulæ theatrales*."

the beauty of her situations and distances allured and entertained the eye of every judicious beholder. The figures which she inserted had abundance of grace; she designed them with becoming attitudes, and gave them a lively and natural expression. Her merit was inconteſtably acknowledged, and her works were exceedingly prized and coveted.

PAO-TING-FOU, in China, where the viceroy resides, is the most considerable city in the province next to Pekin. It has 20 others under its jurisdiction, three of the second and 17 of the third class. The country around it is pleasant, and inferior in fertility to no part of China. It is necessary to pass this city in going from Pekin to the province of Chan-si.

PAOLO (Marco). See PAULO.

PAPA, a small but strong town of Lower Hungary, in the county of Vesprin. It was taken from the Turks in 1683, after raising the siege of Vienna, and is subject to the house of Austria. It is seated on a mountain, near the river Marchaez, in E. Long. 18. 10. N. Lat. 47. 20.

PAP-CASTLE, in England, in Bridekirk parish, Cumberland, stood two miles from Cockermouth, on the other side of the Darwent, whose Roman antiquity is proved by several monuments; and a large green stone vessel found here, with little images upon it, is supposed to have been formerly a Danish font for dipping of infants; and has been since used at Bridekirk in the neighbourhood for their sprinkling.

The name of *Pap-castle* seems to be contracted from Pipard its owner: it is said to have been demolished, and the materials employed to build Cockermouth castle.

Mr Routh, in a letter to Mr Gale, thus describes the ruins discovered at Pap-castle, Jan. 16. 1741-2.

*Camden's Britannia, Gough's edit.*

"I made particular inquiry of the man in whose grounds they were discovered, and of some of the neighbours present at the discovery. The close in which they lay is a little to the south of the fort, on the declivity of the hill to the river, and bounded on the west by a narrow lane, probably the *via militaris* continued; and is usually shown to strangers as the most remarkable here for finding Roman coins. They are the largest ruins ever known to be discovered in these parts: for they met with three walls besides the pavement; the first lay east and west, and was covered with earth near a foot high; parallel to it at seven yards, they found a second; and between these two, about two yards deep (the height of the walls, which were six yards broad, and strongly cemented), they came to a pavement curiously laid with large flags, three quarters of a yard square, and two or three inches thick, as I measured them: but imagining there must be money under it, they covered it up till night, and then tore it all up. It was composed of flags of different thickness: under the thinner was a coarse strong cement, which caused them to be broken in taking up; but the thicker are pretty entire. Part of the wall stood on the floor, and the edge was secured by a fine red cement two inches thick, supposed to be intended to keep the floor dry. They imagined themselves at the corner of the building, the third wall standing at right angles with the first, and the second parallel to the stony lane, on which was an old hedge. On the floor they found a stone trough, or rather base of a pillar, about a foot high, and the hollowed part square, and two inches deep. They likewise found a small earthen patera, which I procured, of the fine red clay, beautifully smooth, with letters impressed on the bottom; but so defaced as not to be intelligible.—Some years ago, the man's father who found these ruins dug up a conduit. The owner had no coins, nor knew of any. One of his neighbours showed me a large brass one defaced."



Mr Routh, in another letter to Mr Gale, April 13. 1743, describes a fibula, a coin of Trajan, ... IANO AVG.... P. M. Rev. the emperor seated on a pile of arms, a trophy before him, S. P. Q. R. OPTI.. .. S. C. and two oaken pieces of the adjoining timber of a house which appeared to have been burnt, in the gardens of Jerom Tully, Esq; of Carlisle. The earth as far as they dug was artificial, and antiquities are only found at a considerable depth.

Dr Stukeley says, the Roman castrum lies on the top of the hill above the village, and he traced its whole circumference, a bit of the Roman wall by the river side going to Wigton, and there the ditch is plainly visible, though half filled up with the rubbish of the wall. A subterraneous vault, floored with large slabs of free stone, was found in the pasture of the south-east angle. The name of *Boroughs* includes both closes where it stood; and they find stones and slates with iron pins in them, coins, &c. on the whole spot below it, towards the water side. It was a beautiful and well chosen plan, on the south-west side of a hill, a noble river running under, and pretty good country about it. Coins of Claudius, Adrian, and a silver Geta, PONT. *rev.* PRINCEPS IVVENTVTIS. He supposes its ancient name *Derventio*, derived from the Darwent.

PAPAVER, the Poppy: A genus of the monogynia order, belonging to the polyandria class of plants; and in the natural method ranking under the 27th order, *Rhoeadeæ*. The corolla is tetrapetalous; the calyx diphyllous; the capsule bilocular, opening at the pores below a persisting stigma.

*Species.* 1. The somniferum, or somniferous common garden-poppy, rises with an upright smooth stalk, dividing or branching a yard or more high; garnished with large, deeply jagged, amplexicaule, smooth leaves; and terminated by large, spreading, dark purple, and other coloured flowers, in the varieties, having smooth cups and capsules. There are a great many varieties, some of them extremely beautiful. The white officinal poppy is one of the varieties of this sort. It grows often to the height of five or six feet, having large flowers, both singles and doubles, succeeded by capsules or heads as large as oranges, each containing about 8000 seeds.

Plate CCCLXXIII.

We are told, that in the province of Bahar in the East Indies, the poppy seeds are sown in the months of October and November, at about eight inches distance, and well watered, till the plants are about half a foot high, when a compost of dung, nitrous earth, and ashes, is spread over the areas; and a little before the flowers appear, they are again watered profusely till the capsules are half grown, at which time the opium is collected; for when fully ripe, they yield but little juice: two longitudinal incisions from below upwards, without penetrating the cavity, are made at sunset for three or four successive evenings; in the morning the juice is scraped off with an iron scoop, and

*Leigh on Opium.*

Papaver. and worked in an iron pot in the ſun's heat till it is of a conſiſtence to be formed into thick cakes of about four pounds weight; theſe are covered over with the leaves of poppy, tobacco, or ſome other vegetable, to prevent their ſticking together, and in this ſituation they are dried.

The ſomniferous quality of the white poppy is well known. This quality reſides in the milky juice of the capſule containing the ſeeds, nor is it evaporated by drying the juice; hence the dried capſules are preſerved in the ſhops for making the ſyrup. The inſpiſſated juice itſelf is a kind of opium; and for an account of its virtues ſee the article Opium. The ſeeds alſo make a very agreeable emulſion, but have no ſoporific virtue.

*Woodville's Medical Botany.* It grows in England, generally in neglected gardens, or uncultivated rich grounds, and flowers in July and Auguſt. This ſpecies is ſaid to have been named *white poppy* from the whiteneſs of its ſeeds; a variety of it, however, is well known to produce black ſeeds; the double-flowered white poppy is alſo another variety: but for medicinal purpoſes, any of theſe may be employed indiſcriminately, as we are not able to diſcover the leaſt difference in their ſenſible qualities or effects. The ſeeds, according to ſome authors, poſſeſs a narcotic power; but there is no foundation for this opinion: they conſiſt of a ſimple farinaceous matter, united with a bland oil, and in many countries are eaten as food. As a medicine, they have been uſually given in the form of emulſion, in catarrhs, ſtranguries, &c. The heads or capſules of the poppy, which are directed for uſe in the pharmacopœias, like the ſtalks and leaves, have an unpleaſant ſmell, ſomewhat like that of opium, and an acrid bitteriſh taſte. Both the ſmell and taſte reſide in a milky juice, which more eſpecially abounds in the cortical part of the capſules, and in its concrete ſtate conſtitutes the officinal opium. Theſe capſules are powerfully narcotic or anodyne; boiled in water, they impart to the menſtruum their narcotic juice, together with the other juices which they have in common with vegetable matters in general. The liquor, ſtrongly preſſed out, ſuffered to ſettle, clarified with whites of eggs, and evaporated to a due conſiſtence, yields an extract which is about one-fifth or one-ſixth of the weight of the heads. This poſſeſſes the virtues of opium, but requires to be given in double its doſe to anſwer the ſame intention, which it is ſaid to perform without occaſioning a nauſea and giddineſs, the uſual effects of opium. This extract was firſt recommended by Mr Arnot and a ſimilar one is now received in the Edinburgh Pharmacopœia. It is found very convenient to prepare the ſyrup from this extract, by diſſolving one drachm in two pounds and a half of ſimple ſyrup. The *ſyrupus papaveris albi*, as directed by both colleges, is a uſeful anodyne, and often ſucceeds in procuring ſleep, where opium fails; it is more eſpecially adapted to children. White poppy heads are alſo uſed externally in fomentations, either alone, or more frequently added to the decoction *pro fomento*. Papaver Papaw.

2. The rhœas, or wild globular headed poppy, riſes with an upright, hairy, multiflorous ſtalk, branching a foot and a half high; garniſhed with long, pinnatifid, deeply cut, hairy leaves; the ſtalk terminated by many red and other coloured flowers in the varieties, ſucceeded by globular ſmooth capſules. Plate CCCLXXIII.

This plant is common in corn fields, and flowers in June and July. It may be diſtinguiſhed from *p. dubium*, to which it bears a general reſemblance, by its urn-ſhaped capſules, and by the hairs upon the peduncles ſtanding in a horizontal direction. The capſules of this ſpecies, like thoſe of ſomniferum, contain a milky juice, of a narcotic quality, but the quantity is very inconſiderable, and has not been applied to any medical purpoſe; but an extract prepared from them has been ſucceſsfully employed as a ſedative. The flowers have ſomewhat of the ſmell of opium, and a mucilaginous taſte, accompanied with a ſlight degree of bitterneſs. A ſyrup of theſe flowers is directed in the London Pharmacopœia, which has been thought uſeful as an anodyne and pectoral, and is therefore preſcribed in coughs and catarrhal affections; but it ſeems valued rather for the beauty of its colour than for its virtues as a medicine. *Woodville.*

3. The Cambricum, or Welſh poppy, has a perennial root, pinnated cut leaves, ſmooth, upright, multiflorous ſtalks, a foot and a half high: garniſhed with ſmall pinnated leaves, and terminated by many large yellow flowers, ſucceeded by ſmooth capſules.—The flowers appear in June.

4. The orientalis, or oriental poppy, hath a large, thick, perennial root; long, pinnated, ſawed leaves; upright, rough, uniflorous ſtalks, terminated by one deep red flower, ſucceeded by oval, ſmooth, capſules. The flowers appearing in May.

*Propagation.* All the kinds are hardy, and will proſper anywhere. The two firſt ſpecies being annual, are to be propagated only by ſeeds; but the two laſt by parting the roots as well as the ſeeds.

PAPAW, or Papa tree. See Carica.

# PAPER.

PAPER is a word evidently derived from the Greek παπυρος *papyrus*, the name of that celebrated Egyptian plant which was ſo much uſed by the ancients in all kinds of writing. It would be unneceſſary partilarly to deſcribe the different expedients which men in every age and country have employed for giving ſtability to their ideas, and for handing them down to their children. When the art of writing was once diſcovered, ſtones, bricks, leaves of trees, the exterior and interior bark, plates of lead, wood, wax, and ivory, were employed. In the progreſs of ſociety, men have invented the Egyptian paper, paper of cotton, paper manufactured from the bark of trees, and in our times from old rags.

The inhabitants of Ceylon, before the Dutch made themſelves maſters of the iſland, wrote on the leaves of the talipot. The manuſcript of the bramins, ſent to Oxford from Fort St George, is written on the leaves

of

of a palm of Malabar. Herman speaks of another palm in the mountains of that country which produces leaves of several feet in breadth. Ray, in his History of Plants, Vol. II. Book xxxii. mentions some trees both in India and America, the leaves of which are proper for writing. From the interior substance of these leaves they draw a whitish membrane, large, and somewhat like the pellicle of an egg; but the paper made by art, even of the coarsest materials, is much more convenient in use than any of these leaves.

The Siamese, for example, make two kinds of paper, the one black and the other white, from the bark of a tree which they call *Pliokkloi*. These are fabricated in the coarsest manner; but they can be used on both sides with a bodkin of fullers earth.

The nations beyond the Ganges make their paper of the bark of many trees. The other Asiatic nations within the Ganges, excepting those toward the south, make it of old rags of cotton cloth; but from their ignorance of the proper method, and the necessary machinery, their paper is coarse. This, however, is by no means the case with that made in China and Japan, which deserves attention from the beauty, the regularity, the strength, and fineness of its texture. In Europe they have discovered, or rather carried to perfection, the ingenious art of making paper with old rags, originally either from flax or hemp; and since this discovery the paper produced from our manufactures is sufficient for every purpose. And though these materials have been hitherto abundant, several philosophers have attempted to substitute other vegetable substances in their place. In the 6th volume of the Transactions of the Society for the Encouragement of Arts, we have an account of paper made by Mr Greeves near Warrington from the bark of willow twigs; and it has been observed by a society of able critics, that hop buds would probably answer this purpose better. The rags in common use for paper-making are a texture of supple and strong fibres separated by a ley from the bark of the plants. It would be in vain to employ the whole body of the plant, as this substance forms a very improper stuff for the operations of the paper mill. From these principles we are directed in the choice of vegetable substances fit for the present purpose. The greater or less degree of purity in the materials is not absolutely necessary; for flax itself, without any preparation, could be made into paper; but it would be extremely coarse, and the bark of nettles or mallows would not bear the expence of labour. Although cotton be used in the fabrication of paper in the Levant, and perhaps in China, we are not to conclude that the down of plants in Europe, without the strength or suppleness of cotton, will answer the same purpose.

## History.

The chief kinds of paper which merit attention in this work are, 1. The Egyptian paper; 2. The paper made from cotton; 3. Paper from the interior bark of trees or liber; 4. Chinese paper; 5. Japanese paper; 6. Paper made from asbestos; and, 7. Paper made from linen rags.

1 Egyptian paper.

This is the famous paper used by the ancients, which was made of a kind of reed called *papyrus*, growing in Egypt on the banks of the Nile. According to Isidorus, this paper was first used at Memphis, and Lucan seems to be of the same opinion,

*Nondum flumineas Memphis connexere biblos*
*Noverat.* PHARSAL. Lib. III. ver. 222.

Whatever truth may be in this, it is certain, that of all the kinds of paper used by the ancients, the papyrus was the most convenient, both from its flexibility and from the ease of fabrication. It was a present from nature, and required neither care nor culture.

It is not certain at what particular period the ancients began to make paper of papyrus; but there are several authorities which prove the use of it in Egypt long before the time of Alexander the Great.

Pliny, lib. xiii. cap. 11. gives a full description of the method of making this paper in Egypt. They divide, says he, with a kind of needle the stem of the papyrus into thin plates or slender pellicles, each of them as large as the plant will admit. These are the elements of which the sheets of paper are composed. The pellicles in the centre are the best; and they diminish in value as they depart from it. As they were separated from the reed, they were extended on a table, and laid across each other at right angles. In this state they were moistened by the water of the Nile, and while wet were put under a press, and afterwards exposed to the rays of the sun. "It was supposed that the water of the Nile ‡ had a gummy quality necessary to glue these stripes together. This, says Mr Bruce, we may be assured is without foundation, no such quality being found in the water of the Nile; on the contrary, I found it of all others the most improper, till it had settled and was absolutely divested of all the earth gathered in its turbid state. I made several pieces of this paper both in Abyssinia and Egypt; and it appears to me, that the sugar or sweetness with which the whole juice of this plant is impregnated, is the matter that causes the adhesion of these stripes together; and that the use of the water is no more than to dissolve this, and put it perfectly and equally in fusion." When there was not enough of sugar in the plant, or when the water did not sufficiently dissolve it, the pellicles were united by a paste made of the finest wheat flour, mixed with hot water and a little vinegar, and when dried they were flattened and smoothed by the beating of a mallet.

‡ *Pliny*, Lib. XIII. c. 12.

The size of this paper varied much; it seldom exceeded two feet, but it was oftentimes smaller. It had different names according to its size and quality: The first was called *Imperial*, which was of the finest and largest kind, and was used for writing letters by the great men amongst the Romans. The second sort was called by the Romans the *Livian* paper, from Livia the wife of Augustus; each leaf of this kind was 12 inches. The third sort was called the *Sacerdotal* paper, and was 11 inches in size.

The paper used in the amphitheatres was of the dimensions of nine inches. But what was esteemed of greatest value in it, was its strength, whiteness, and polish. The ink, however, sunk less in paper highly polished; and therefore the characters were more liable to be effaced. When it was not carefully soaked in the first preparation, the paper brought a less price; because

*Panorpa.*

*Panax Quinquefolium.*

*Papaver Rhoeas.*

*Papaver somniferum.*

because letters were with difficulty formed upon it, and it sent forth a disagreeable smell. To remedy this defect, the paper went though a new course of sizing and hammering; and the size used on that occasion was made of light bread steeped in boiling water, and passed through a filtering cloth. By this means the paper became in the highest degree united, and smoother than the finest linen. It was this paper which gave so long a duration to the works of the Gracchi, Tiberius, and Caius, in their own handwriting. "I have seen them (says Pliny) in the library of Pomponius Secundus, a poet and citizen of the first rank, near 200 years after they were written." We may add, that manuscripts of this paper still remain, which have undoubtedly been written 1000 or 1200 years ago. It appears from Pliny, that the Egyptians pasted together the pellicles of the papyrus by means of the water of the Nile; but that the polishing with ivory, and the operations of the hammer and the press, were added by the invention and industry of the Roman artists. The Egyptians seem to have known the use of size; but it is evident from the same author, that the Romans used a stronger size in the making of paper. Notwithstanding the care which was taken to give strength and consistency to the paper of Egypt, the leaves, although collected into a book, were too weak to support themselves; and for this reason it was a common practice, after every five leaves, to insert a leaf of parchment. There still remains in the abbey de St Germain de-pres a fragment of the epistles of St Augustine written in this manner. The manuscript is at least 1100 years old, and in a high state of preservation.

This paper was an important branch of commerce to the Egyptians, which continued to increase towards the end of the Roman republic, and became still more extensive in the reign of Augustus. The demand from foreign nations was often so great, as to occasion a scarcity at Rome; and we read in the reign of Tiberius of a tumult among the people in consequence of this scarcity. In a letter of the emperor Adrian, the preparing of the papyrus is mentioned as one of the principal occupations at Alexandria. "In this rich and opulent city (says he) nobody is seen idle: Some are employed in the manufactory of cloth, some in that of writing paper," &c. During the time of the Antonines, this commerce continued equally to flourish. Apuleius says, that he wrote on the paper of Egypt with a reed of the Nile prepared at Memphis.

The demand for this paper was so great towards the end of the third century, that when the tyrant Firmus conquered Egypt, he boasted that he had seized as much paper and size as would support his whole army.

St Jerome informs us, that it was as much in use in the fifth century when he flourished. The duty on the importation of this commodity had grown excessive towards the end of this or the beginning of the sixth century; and being abolished by Theodoric king of Italy, Cassiodorus, in the 38th letter of his 11th book, congratulates the whole world on the discharge of an impost on a merchandise so essentially necessary to mankind.

The fathers Montfaucon and Mabillon mention several fragments written on this paper in the sixth century. One of them was a charter of the emperor Justinian, entitled, *Charta plenariæ securitatis*. Father Montfaucon saw in 1698, in the library of Julio Justiniani, three or four fragments of paper of Egypt of the same antiquity. And Mabillon speaks of some books of the Jewish antiquities by Josephus translated into Latin, which seemed to have been written in the same century, and which were preserved in the library of St Ambrose of Milan, but he had not seen the manuscripts. The same father mentions to have seen in the library of St Martin of Tours the remains of an old Greek manuscript of the paper of Egypt, and which appeared to him to be of the seventh century. He also believes, that the copy of St Mark's gospel preserved in the register office of Venice is written on the same paper, that it is the most ancient of any of the evangelical manuscripts, and may be supposed to be written at the latest in the fourth century.

According to the same antiquarian, the paper of Egypt was used in France, in Italy, and other European countries, both for books of learning and public records; and there still remains, adds he, a great number of these in the archives of the church at St Dennis, at Corbie, in the abbey de Grasse, and in other convents.

It is probable, that the invention of paper made of cotton, of which we are afterwards to treat, insensibly destroyed the reputation and manufacture of the paper of Egypt; but it is still a question at what particular period the fabrication of the latter totally ceased. Eustachius, the learned commentator on Homer, assures us, that in his time in 1170 it was no longer in use; but Father Mabillon maintains, that many of the popish bulls were written on the papyrus in the 11th century.

The Count Maffei, in his *Istor Diplomat.* Lib. II. *Biblioth. Ital.* Tom. II. p. 251. is decidedly of opinion, that the paper of Egypt was not in use in the fifth century. He considers all records written on this paper dated posterior to this period as not authentic; and the popish bulls mentioned by Father Mabillon appear to this learned person, as well as the copy of St Mark's gospel, to be written on paper manufactured from cotton. To reconcile in some measure these contradictory accounts, it may be observed, that on some particular occasions, and by some particular persons, the paper of Egypt might have been employed for several hundred years after it ceased to be of general use. Whoever wishes for a fuller account of the paper of Egypt, may consult among the ancients Pliny, lib. xiii. and Theophrastus, lib. iv. chap. ix. and among the moderns, Guillandinus, Scaliger, Saumaise, Kerchmayer, Ngrisoli; Father Hardouin in his edition of Pliny; Father Mabillon in his work *De re Diplomat.*; Montfaucon in his Paleography, and in his Collections; the illustrious Maffei in his *Istor. Diplomat.* the Count de Caylus in the Memoirs of the Academy of Inscriptions, and Mr Bruce in his Travels to discover the Source of the Nile.

It is generally supposed that the invention of the paper, called *charta bombycina*, supplanted the Egyptian paper in Greece. This paper is incomparably more lasting, and better calculated for all the purposes of writing. It is not precisely known at what period this art, which supposes a great variety of previous experiments, 2 Paper made from cotton.

experiments, was first reduced to practice. The application of cotton to the purposes of paper-making requires as much labour and ingenuity as the use of linen rags; and for this reason, if we could determine the precise time when paper was made from cotton, we should also fix the invention of the art of paper-making as it is presently practised in Europe. Father Montfaucon proves, by incontestable authorities, that paper from cotton was used in 1100. This paper in the Greek language is called χαρτης βομβυκινος, or βαμβακινος; for although βομβυξ is the Greek word for silk, yet in those times it was applied, as well as βαμβαξ, to cotton: and hence the Italians to this day call cotton *bambaccio*.

The most ancient manuscript of this paper which Father Montfaucon saw with the date, was that in the French king's library, written A. D. 1050; but as the manuscripts without date are infinitely more numerous than those which are dated, and as some conjecture can be formed concerning them from the manner of writing, this father believes some of these to have been written in the tenth century.

The researches of the same learned antiquarian amount almost to a proof that this paper was discovered towards the end of the ninth century or beginning of the tenth; for before the twelfth century it was commonly used in the eastern empire, and even in Sicily. Roger king of Sicily says, in a diploma written in 1145, that he had renewed on parchment a charter which had been written on paper of cotton, in the year 1100, and another which was dated in the year 1112. About the same time the empress Irene, in the statutes for some religious houses at Constantinople, says that she had left three copies of the same statutes, two in parchment and one in paper from cotton. From that period this paper was still more in use through all the eastern empire; and innumerable Greek manuscripts are found written on it in all the great libraries.

This discovery happened at a time when there seems to have been a great scarcity of parchment; for it was about this period that the Greeks erased the writings of Polybius, Diodorus of Sicily, and many valuable ancient authors, for the sake of the parchment.

It was the invention of this paper of cotton which destroyed the manufactures of the paper of Egypt; for, if we may believe Eustathius, who wrote towards the end of the twelfth century, the latter paper had gone into disuse but a little before his time. We may easily believe, however, that this new invention, although of great advantage to mankind, was introduced by degrees.

The manufacture of this kind of paper has flourished in the Levant for many ages, and is carried on with great success even to this day. It is not necessary to say any thing farther, than that the paper produced from cotton is extremely white, very strong, and of a fine grain.

3 Paper from the interior bark of trees or liber.

This paper of the ancients was made from the white pellicle or inner coat found in many trees between the bark and the wood. The trees commonly in use were the maple, the plane tree, the elm, the beech, the mulberry, and most frequently the linden tree. The ancients wrote on this inner coat after they had separated it from the bark, beat, and dried it.

The fathers Mabillon and Montfaucon speak frequently of manuscripts and diplomas written on paper made from bark; and positively distinguish it from the Egyptian paper, because it was thicker, and composed of parts less adhering together.

There are many palm trees in India and America to which botanists have given the name *papyraceous*, because the natives have written with bodkins either on the leaves or the bark. Such is the American palm, called *tal* by the Indians; and of the same kind is the guajaraba of New Spain. Every palm, the bark of which is smooth, and the leaves large and thick, may be used for this purpose.

4 Chinese paper.

The art of making paper from vegetables reduced to stuff was known in China long before it was practised in Europe; and the Chinese have carried it to a degree of perfection hitherto unknown to the European artists. The fine paper in China is softer and smoother than that of Europe; and these qualities are admirably adapted to the pencil, which the Chinese use in writing. Several kinds of their paper discover the greatest art and ingenuity, and might be applied with much advantage to many purposes. They are capable of receiving, for example, the impression of types; and both maps and prints have been executed with success on the Chinese paper.

The different sorts of paper vary in China according to the materials of which they are composed, and to the different manner of manufacturing those materials. Every province has its peculiar paper. That of Se-chwen is made of linen rags as in Europe; that of Fo-kien, of young bamboo; that of the northern provinces, of the interior bark of the mulberry; that of the province of Kiang-nan, of the skin which is found in the webs of the silk worm; finally, in the province of Hu-quang, the tree chu or ko-chu furnishes the materials with which they make paper.

The method of fabricating paper with the bark of different trees is nearly the same with that which is followed in the bamboo. To give an idea, therefore, of the manner of manufacturing the interior barks of the mulberry, the elm, and the cotton tree, it will be sufficient to confine our observations to the bamboo.

The bamboo is a kind of cane or hollow reed, divided by knots; but larger, more elastic, and durable than any other reed.

The whole substance of the bamboo composed of filaments, and a great abundance of fibrous materials, is employed in this operation. The shoots of one or two years, nearly the thickness of a man's leg, are preferred. They strip the leaves from the stem, cut them into pieces of four or five feet long, make them into parcels, and put them into water to macerate. As soon as they are softened, which generally happens in five days; they wash them in pure water; put them into a dry ditch; cover them with lime for some days, which they water for the purpose of slacking: they wash them carefully a second time; cut every one of the pieces into filaments, which they expose to the rays of the sun to dry and to bleach them. After this they are boiled in large kettles, and then reduced to stuff in mortars of wood, by means of a hammer with a long handle, which the workman moves with his foot.

The stuff being thus prepared, they take some shoots of

of a plant named *koteng*, which, steeped in water four or five days, is reduced to an unctuous or glutinous substance; and when they proceed to make the paper, this is mixed with the stuff in certain exact quantities, for on this mixture depends the goodness of the paper.

When the extract from the koteng is mixed with stuff of the bamboo, the whole mixture is beat together in mortars till it becomes a thick and viscous liquor. This is poured into large tubs or reservoirs, so exactly framed as that no part of the liquor can escape.

The workmen after this plunge their forms into the liquor; take out what is sufficient for a sheet of paper; which immediately, from the glutinous substance, becomes firm and shining; and is detached from the form by turning down the sheet on the heap of paper already made, without the interposition of pieces of woollen cloth, as in Europe.

In order to dry this paper, they have a hollow wall, the two fronts of which are smooth and extremely white. At the extremity of this wall is placed a stove, the pipes of which are carried in a circular manner through the whole empty space. The sheets of paper are laid on the surface, to which they adhere till they come over them with a soft brush; and after they are dry, it is easy to distinguish the side which received impressions from the brush from that which adhered to the wall. By means of this stove the Chinese dry their paper as fast as they can make it; but it is only in cold seasons, or in certain provinces, that they find this expedient necessary.

The Chinese paper must be dipped in a solution of alum before it can take either ink or colours. They call this operation *faner*, from the Chinese word *fan*, which signifies alum. The following is the manner of preparing this solution: Six ounces of isinglass cut very small is put into boiling water, and constantly stirred, that it may dissolve equally. When the isinglass is wholly dissolved in the water, they throw in twelve ounces of calcined alum, which is also stirred till it is completely dissolved and mixed with the isinglass. This composition is afterwards poured into a large and deep bason, at the mouth of which is a little round piece of wood; the extremity of every sheet of paper is fixed in another piece of wood, with a slit made to receive it; by means of this equipage they plunge the sheet of paper into the composition of alum and isinglass; and when it is fully penetrated, they draw it out, making it glide over the little round piece of wood. The long piece of wood which holds the sheet by one end, and keeps it from tearing, is afterwards suspended with it on a wall till it is sufficiently dry.

The Chinese give the paper intended for different purposes different preparations. We shall confine our observations to the silver colour which they give to some paper. They take two scruples of paste made of cows hide, one scruple of alum, and a pint of water: the whole is boiled on a slow fire till the water be evaporated. The sheets of paper are then stretched on a smooth table, and covered over with two or three layers of this paste. They take afterwards a certain quantity of talc, washed and boiled in water, with the proportion of one third of alum; this is dried, reduced to a powder, passed through a sieve, boiled a second time in water, dried in the sun, and again passed through the sieve. This powder is spread equally over the sheets of paper, prepared as we mentioned above; and then they are dried slowly in the shade.

The sheets of paper, covered in this manner with talc, are laid upon a table, and rubbed with a little cotton; which fixes a certain quantity of the talc in the paper, and carries off the overplus to be used on another occasion. By means of this composition the Chinese drew all manner of figures on their paper.

Formerly the Chinese wrote with a bodkin of iron on tablets of bamboo; afterwards on satin with a pencil; and during the dynasty of their tyrants, about 160 years before Christ, they discovered the art of making paper.

The paper made from the bamboo is sufficiently white, soft, closely united, without the least inequality on the surface to interrupt the motion of the pencil, or to occasion the rising of the materials which compose it. Meanwhile every kind of paper made from the bamboo or the bark of trees, is readier to crack than that made in Europe; besides, it is more susceptible of moisture, and sooner destroyed with dust and worms. To obviate this last inconveniency, they are obliged frequently to beat their books in China, and to expose them to the sun. It may be observed, however, that the Chinese paper, employed for various purposes in Europe, has been preserved for a long time without receiving damage either from moisture or insects.

5
Japanese paper.

According to Kempfer, the bark of the *morus papifera sativa*, or true paper tree, is chiefly employed for making paper in Japan. Every year after the fall of the leaves, which happens in the tenth month, corresponding to our December, the Japanese cut the young shoots of this tree into pieces of about three feet, collect them into parcels, which they boil in water into which they have cast a certain quantity of ashes. If the wood is dry, they take care to steep it 23 hours in water before it is boiled. The parcels are kept in a close copper till the bark at the extremity of the shoots is separated from the stem about half an inch; they are then cooled; and the bark alone is fit for making paper. They begin by a preparation which consists of cleaning the bark, and separating the good from the bad. For this purpose they steep it in water three or four hours; and as soon as it is softened they scrape off with a knife whatever is blackish or green, and at the same time separate the strong bark of a year's growth from the slender which covers the young shoots. The first of these gives the whitest and best paper. If there is any of the bark of more than a year's growth, it is laid aside for the coarsest.

After the bark has been culled and cleaned in this manner, it is boiled in a clear ley till the matter is of that consistency, that, being touched gently with the finger, it draws off in the form of hairs, or like a collection of fibres. During the time of boiling it is constantly stirred with a strong reed, and the waste by evaporation supplied from time to time with additional quantities of the clear ley. To make this ley, they put two pieces of wood across the mouth of a tub, cover them with straw, on which they lay a bed of

of ashes a little moistened; and pouring boiling water on the ashes, the salts contained in them are carried down to the tub. This is what is called a *clear ley*.

After the bark is in the condition we have just now stated, it is washed with great care; for on this washing depends in a great measure the goodness of the paper. It is put into a kind of sieve through which the water can flow freely; and great care is taken to turn it with the hand till it is sufficiently diluted, and reduced to soft and tender fibres. For the finest paper a second washing is requisite, and a piece of cloth is used instead of a sieve.

When the bark is washed, it is laid on a strong and smooth table, and beat with a kind of baton of hard wood till it is reduced to a proper consistency. It becomes indeed so soft, that it resembles paper steeped in water.

The bark prepared in this manner is put into a narrow tub, with a glutinous extract from rice and the root oreni, which is very viscous. These three substances, mixed together, are stirred with the reed till they form a liquor of an equal and uniform consistency. This composition is poured into tubs similar to those used for filling the forms in our paper mills.

As soon as the sheets are made and detached from the form, they are laid in a heap on a table covered with a double mat. A small chip of cane is placed betwixt every sheet. This piece of cane jutting out, serves to distinguish the sheets, and afterwards to raise them. Every one of the heaps is covered with a plate or thin board of the exact size of the paper. In proportion as the paper dries, or is able to bear it without danger of being compressed into one mass, they lay on additional weights. This pressure, intended to carry off any unnecessary moisture, is continued for 24 hours, when the sheets are suspended, by means of the little pieces of reed, to long plants, in the open air, till they are completely dried.

The extract from rice is made in an unvarnished earthen pot. The pot is agitated at first gently, then more briskly: new water is poured in, and then it is filtered through a linen cloth. The finishing of the process is determined by the viscosity of the substance.

The infusion of the root oreni is made in the following manner: The root, peeled and cut into small pieces, is infused into water for one night, during which time it communicates a viscosity sufficient for the purpose to which it is applied.

The Japanese paper is of so prodigious a strength, that the materials of which it is composed might be manufactured into ropes. There is sold at Serige, the capital city of the province of Japan of that name, a kind of it fit for bed hangings and wearing apparel; resembling so much stuffs of wool and silk, that it is often taken for them. The following is Kempfer's catalogue of trees used in Japan for the manufactory of paper. 1. The true paper tree, called in the Japanese language, *kaadsi*, Kempfer characterizes thus: *Papyrus fructu mori celsæ, sive morus sativa foliis urticæ mortuæ cortice papifera*. 2. The false paper tree, called by the Japanese, *katsi kadsire*; by Kempfer, *papyrus procumbens lactescens folio longo lanceata cortice chartaceo*. 3. The plant which the Japanese call *oreni* is named by Kempfer *alva radice viscosa flore ephemero magno punico*. 4. The fourth tree used for paper is the *futokadsura*, named by Kempfer *frutex viscosus procumbens folio telephii vulgaris æmulo fructu racemoso*.

The description of these trees, given more particularly by Kempfer than the limits of this work will permit, may be of great service to lead botanists to discover the European plants and shrubs adapted, like the Japanese, for the fabrication of paper.

Before finishing our reflections on this part of the subject, it will be proper to give a just idea of the attempts which have been made to increase the original materials of paper in Europe.

A slight attention to the process in China in reducing the bamboo to a paste, by a careful and ingenious analysis, and to the long and proper method of the Japanese of separating the principal fibres of the bark of the mulberry, will show the absurdity not only of taking plants without any kind of choice, but of giving them no preparation except that of pounding them with mallets.

With a proper selection, and good principles, it appears not improbable that many of the European plants might be used with great advantage in constructing several kinds of paper.

It is evident that the materials used by the Chinese require less labour and preparation than the stuff of linen rags. The sheets of the Chinese paper are easily detached from the form; they are laid in heaps without the interposition of pieces of woollen cloth; the superfluous water is immediately discharged; and they require not, as in Europe, the vigorous action of presses to unite the parts more closely together. 6

**Paper made from asbestos.** The asbestos is a fibrous substance of little strength, the threads of which are easily broken. This substance has the peculiar quality of supporting the action of fire without receiving any damage; whence pieces of cloth and garters made of it are incombustible. From the knowledge of this property paper has been made of the asbestos. Dr. Brukman, professor at Brunswick, published the natural history of this fossil; and four copies of his book, in the library of Wolfenbuttle, are on this paper.

The manner of fabricating this paper is described by M. Lloyd in the Philosophical Transactions, N° 166. A certain quantity of the asbestos is pounded in a mortar of stone till it be reduced to a substance like cotton. All the parts of earth or stone remaining in the asbestos are then taken off by means of a fine sieve, and it is formed into sheets of paper by an ordinary paper mill. Mixing it with water reduces it to stuff; only, as it is heavier than that from linen rags, it requires to be continually stirred when they are taking it up with the frames. The only excellence of this paper is, that the writing disappears when it is cast into the fire. It must be observed, at the same time, that as it is of a slender consistency, and easily torn, it is more an object of curiosity than use. 7

**Paper made from rags.** This paper is manufactured through all Europe of linen rags collected in the cities and in the country. This kind of paper was utterly unknown to the ancients. The *libri lintei* mentioned by Livy, I. lib. iv. Pliny, XIII. c. xi. and by other Roman writers, are demonstrated by Guilandin, in his commentary on Pliny, &c. to have been written on pieces of linen cloth, or canvass prepared in the manner of painters.

But

But it is not sufficient to be certain that paper from linen is a modern invention; it is necessary to know by what nation, and at what period, it was discovered. Polydore Virgil, *De Inventoribus Rerum*, C. II. c. viii. confesses his ignorance of these facts. Scaliger, without any kind of proof, gives the glory to the Germans; and Count Maffei to the Italians. Other writers ascribe this honour to some Greek refugees at Basil, to whom the manner of making paper from cotton in their own country had suggested the idea. Du Halde is persuaded that Europe derived this invention from the Chinese, who, in several provinces, make paper of rags nearly in the same manner that we do. But this invention was practised by the Europeans before they had any communication with China, and before the taking of Constantinople, at which time the Greek refugees were supposed to have retired to Basil. The precise time of this discovery in Europe is not exactly known. Father Mabillon believes that it was in the twelfth century; and cites a passage of Pierre de Clugny, born A. D. 1100, to prove it. The books which we read every day, says that abbé in his treatise against the Jews, are written on sheeps and calfs skin; or on oriental plants; or, finally, *Ex rasuris veterum pannorum*. If these last words signify paper, such as we use, there were books of it in the twelfth century. But this citation is the more to be suspected, as Montfaucon himself, after the minutest search in France and Italy, could find no book on this paper antecedent to the death of St Louis, A. D. 1270.

The epocha of this invention was not determined till 1762, M. Mierman having proposed a reward to the person who could procure the most ancient manuscript written on this kind of paper. The collection of all the memoirs sent to him along with the manuscripts was published at the Hague in 1767; and it appeared that this paper had been used in Europe before the year 1300.

In 1782 the Abbé Andrez published a work entitled *Dell' Origine, Progressi, e Stato attuale d'Ogni letteratura*; wherein he speaks of the discovery of many kinds of paper, and particularly of that made of rags. The Abbé Andrez maintains, that paper made from silk was very anciently fabricated in China, and in the eastern parts of Asia; that the art of making this paper was carried from China to Persia about the year 652, and to Mecca in 706. The Arabs substituted cotton, the commodity of their own country, in place of silk or rather bamboo. This paper of cotton was carried into Africa and Spain by the Arabs. The Spaniards, from the quantity of linen to be found in the kingdom of Valencia, seem first to have adopted the idea of using linen rags; and the most ancient paper of this kind is of Valencia and Catalonia. From Spain it passed into France, as may be learned from a letter of Joinville to St Louis about the year 1260. It is discovered to have been in Germany in 1312, and in England in 1320 and 1342. In consequence of the paper made from cotton in the Levant, the paper from linen was introduced much later into Italy. See the work of Abbé Andrez, printed at Parma, 1782, in 8vo; and Mierman's Collection, published at the Hague.

### Sect. I. *Art of Making Paper in Europe.*

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To give a concise view of this subject, it will be necessary to proceed with all the important parts of the operation in their order.

8 The selection of rags.

The selection of the rags, is the arranging of them into different lots, according to their quality and to the demand of the paper mill. In general this selection is very much neglected: The degrees of fineness and whiteness, distinguished with little care, are thought to be the only objects of importance; whereas the hardness and softness, the being more or less worn, are much more essential in this selection. It is certain, that a mixture of soft and hard rags occasions much more loss in the trituration than a difference in point of fineness or of colour. This exactness in the selection is still more necessary where cylinders are used instead of mallets. We cannot do better than to give the method practised in Holland as worthy of imitation.

They begin by a general separation of the rags into four lots; superfine, fine, middle, and coarse. These lots are given to selectors, who subdivide each of them into five chests. They have besides a bench, on which is fixed vertically a hook, and a piece of scythe which is terminated by a crooked point.

The person, for example, who has the charge of the fine lot, puts into one of the chests the hard rags, or those which are little used, into another the soft, into a third the dirty, into a fourth those which are stitched or hemmed, and, finally, into the fifth the superfine rags which happen to be among the fine.

After this process, the women who have the charge of it are at extreme pains to pick out every kind of sewing, and especially the knots of thread and the hems, by means of the hook or scythe which they have under their hands. They take care also by the same means to cut and reduce the rags exactly by the warp and the woof into small pieces. It is of great advantage to cut or tear the pieces of rags by a thread, whether it be by the warp or woof; because if it is done obliquely, many of the ends are lost in the operation.

When they have selected a certain quantity of each of these subdivisions, they are placed on an iron grate, which covers a large chest where they are beat, and otherwise turned, till the filth and dust pass through the bars of the grate and fall into the chest.

The number of lots in the selection of rags must be proportioned to the mass from which the selection is made, and to the kinds of paper produced by the mill. Some mills, the work of which is considerable, make nine lots of their rags, five of which respect the fineness, and the rest the cleanness and the colour. In ordinary mills there are only four lots, and in some two.

We have already observed, that the selection which regards the hardness of the materials is the most essential; because it is of great importance to obtain stuff composed of equal parts, and without any loss. But it is necessary to add, that the fineness and beauty of the paper depend in some cases on a selection not rigorous. Thus, for example, it is of great service to allow

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allow the middle to retain some part of the fine, and the fine some part of the superfine; for without this the inferior kinds of paper can never be of great value. The most common fault is to mix the rags of the inferior lots with the superior; which though it augments the quantity of paper, is extremely injurious to the quality. It does much better to mix part of the superior lots with the inferior. It was the want of attention to this mixture which makes some paper mills excel in the superior sorts of paper while the inferior kinds are of a very bad quality.

The selection of rags being made with exactness, however, and the lots being fermented and triturated separately, the mixture may be made with much greater advantage when they are both reduced to stuff; always taking care that it be in the same proportion as if it were in the state of rags, and only in the manner which we just now mentioned; for the inferior sorts gain more in beauty and quality by this mixture than is lost in stuff; whereas if the fine stuff receives a certain quantity of the inferior, the paper is more damaged in its value than increased in quantity. In this manner the interest of the manufacturer, as in all cases, is intimately connected with the goodness of his commodities.

The washing and fermentation of rags.

In some mills the place for fermentation is divided into two parts, one of which serves for washing away the filth from the rags. After allowing them to steep for some time in a large stone vat, they stir them, and pour in fresh water till the impurities connected with the rags run over. When they are as clean as they possibly can be made by this kind of washing, they are laid in a heap to putrefy. In this condition they experience a degree of fermentation, which is first discovered by a mouldiness of the different pieces of cloth. Afterwards the mass grows warm; and then it is of great consequence to attend to the progress of this heat, in order to moderate its effects: for this purpose, the middle of the heap, where the fermentation is strongest, is turned out, and *vice versa*. In mills where mallets are used, the putrefaction is carried to a great height, which is frequently attended with two inconveniences. The first is, that a part of the rags is reduced to an earthy substance, which is found in great abundance about the cutting table, as we shall afterwards have occasion to see. But besides this waste, excessive fermentation makes the stuff incapable of sustaining the action of the mallets till it is equally pounded. A paper made from a stuff too hard and too little fermented, is coarse and ill compacted; that made from rags too much fermented is composed of fibres without softness and without strength.

The second inconveniency is, that the rags turn greasy by too much fermentation, and of consequence it is very difficult to separate and reduce them by all the washings of the trituration.

We shall not describe the form of the place for fermentation, because in different paper works these places are of different constructions: it is sufficient to say, that they are all placed in low situations and made very close. The selected rags are placed in them in heaps, and watered from time to time to bring on the fermentation. In different paper mills they practise different methods in the putrefaction of their rags.

In certain provinces in France, they lay in the place for putrefaction a heap equivalent to what the mill can triturate in a month. When this is equally and sufficiently moistened by means of moveable pipes, they cover it with an old heap, which has lain a month in a state of fermentation. When this old heap is exhausted by the mill, the new one becomes a covering to another, and so on. From this detail it is easy to perceive, that there must be near three weeks difference of putrefaction in the same heap, and also that in this method there is no allowance for those seasons in which the fermentation advances more rapidly.

In general the putrefaction goes on more slowly in proportion to the fineness of the rags. But when, on any occasion, it advances more rapidly than the demand from the mill, the rags are turned over and watered, to stop the fermentation and prevent the bad effects.

All the inconveniences attending the excess of putrefaction are remedied in Holland by machines which triturate the rags without having recourse to it; and their success in this manner of preparing the stuff has attracted the notice of the French artists, some of whom have adopted with advantage the Dutch machinery.

Meanwhile, it is possible to carry the method of putrefaction to much greater perfection; and several manufacturers have made attempts so well concerted, as to deserve the attention of those who study the subject.

In the neighbourhood of Brussels some paper manufacturers, who have constructed their mills after the Dutch plan, have still found it necessary to putrefy their rags; but, at the same time, they have an excellent method for moderating the effects of this putrefaction. In the great galleries connected with the buildings of the paper mill, they have constructed a continuation of chests, capable each of them of containing a certain quantity of rags; for example, the quantity which the cylinder can triturate in one day. The number of chests is equal to the number of days which the rags in any season require for putrefaction; and the number actually employed is greater or less according to the season. In prosecuting this plan, they lay a heap of rags in one chest, as often as they take one from another. It should also be observed, that, for the sake of the fermentation, the rags are first moistened in a large hollow stone before they are arranged into the chests.

The peculiar advantages of this method are, the equal fermentation of the rags, without any part of them being weakened; great ease in washing them; and it is even pretended, that a less degree of fermentation renders the impurities and the discoloured parts both of hemp and linen more soluble, and consequently the stuff of a purer white.

10 Cutting table.

When the rags are reduced to a proper state of putrefaction, they are carried to the cutting table, which is placed on solid tressels, and enclosed on three sides to contain the rags cut on it. Before the table is fixed vertically a part of the blade of a scythe, the edge of which is turned from the operator. This workman, in a situation rather elevated, takes from the left side a handful of the putrefied rags, and arranging them the long way, gives them a gentle twist, presses the half-formed rope against the blade of the scythe, and, in the

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the manner of fawing, cuts it into three or four pieces, which he throws to the right fide of the table. In this operation the rags lofe part of their filth, and efpecially of the earthy particles occafioned by too much putrefaction.

11 Mills for triturating the rags.

When the rags have been fubmitted to all the foregoing operations, they are in a condition to be reduced into a fibrous ftuff, of which the paper is made. To obtain this ftuff, mills are conftructed on different principles. Thofe which have been ufed for a long time over all Europe, and which by a ftatement in the *Encyclopédie Methodique*, publifhed at Paris in 1789, are ftill ufed in France, are mills with mallets. But the mills invented by the Dutch, and ufed in the neighbouring provinces, and, excepting one inftance, in every part of Great Britain, are mills with cylinders or rollers. In the former of thefe, the mallets are raifed by notches fixed at convenient diftances in a large circular beam of wood. The teeth fixed on the end of the mallet fall into a correfponding gap made the whole breadth of the plate, and the ftrokes are repeated till the rags are reduced to a proper confiftency. On fupplying the vat with water, and carrying off all the impurities, the operation is nearly fimilar to that in the mills with cylinders.

Such is the nature of what may be called the *old method of making paper*. It was proper to fpeak of this old method, becaufe at one time, and that not very diftant it univerfally prevailed. That it was inferior to that now in practice, feems very evident; and that the rotting of the rags was peculiarly abfurd, cannot be denied, as the paper made of fermented ftuff could neither be fo ftrong nor fo durable as that which is made in the common way without putrefaction. The only kind of paper that, with any propriety, could be made from putrified ftuff, was pafteboard; but we are informed by the moft intelligent papermakers in Britain, that they feldom or never even putrefy the rags or ropes of which pafteboard is made. It will now be requifite to ftate the method prefently in practice, with the improvements lately made in the art.

12 The dufter.

The dufter is made in the form of a cylinder, four and a half feet in diameter, and five feet in length. It is altogether covered with a wire net, and put in motion by its connexion with fome part of the machinery. A convenient quantity of rags before the felection are enclofed in the dufter, and the rapidity of its motion feparates the duft from them, and forces it through the wire. It is of confiderable advantage to ufe the dufter before felection, as it makes that operation lefs pernicious to the felectors.

The felection is performed much in the fame manner as we have already defcribed; only it is found more convenient to have the tables for cutting off the knots and ftitching, and for forming them into a proper fhape, in the fame place with the cutting table. The furface both of thefe and of the cutting table is compofed of a wire net, which in every part of the operation allows the remaining duft and refufe of every kind to efcape.

The rags, without any kind of putrefaction are again carried from the cutting table back to the dufter, and from thence to the engine, where, in general, they are in the fpace of fix hours reduced to the ftuff proper for making paper. The hard and foft of the fame quality are placed in different lots; but they can be reduced to ftuff at the fame time, provided the foft be put fomewhat later into the engine.

13 Defcription of a paper mill.

The engine is that part of the mill which performs the whole action of reducing the rags to pafte, or, as it may be termed, of trituration. The number of the engines depends on the extent of the paper work, on the force of water, or on the conftruction of the machinery.

It will afford a fufficient idea of the work, to give in detail a defcription of the different parts of the engine. See Plate CCCLXXVI. Figure 1. reprefents the chapiter which covers the roller. It is four feet three inches in length, and two feet eight inches in breadth. The fuperior part is pierced with two openings running crofswife, 1, 2, 3, 4, into which enter the chaffes, or wicker frames, figures 6, and 7.; the firft, made of wire cloth, enters into the opening 3 and 4; the fecond made of hair cloth, and ftrengthened with feveral crofs bars of wood, enters into the opening 1, 2, ferves to retain the fmall pieces of rags which efcape through the firft, and prevents them from falling into the dalot or hole-fcupper, fig. 2. This hole-fcupper is placed acrofs the vat of the engine, parallel to the axle of the roller; the part 9 enters into the notch *c* of the chapiter; and the extremity *h* enters into the opening *k* of the tunnel *kl* (fig. 3.), by which means the water dafhed through the wicker frames by every revolution of the roller is precipitated into the canal *fh*, and lofes itfelf below the engine. The figures 4, 9, and 10, reprefent the roller in perfpective, in plane, and in profile. It is two feet in diameter, and two feet three inches in length. The trundle head A is 16 inches in diameter, about half as much in length, and furnifhed with feven fpindles of iron, which are fcrewed to the end of the trundle head, made alfo of iron. The teeth or blades of the roller are 27 in number, and fitted ftrongly into the wood which compofes its body, parallel to its axis. They are of that thicknefs as to leave as much empty fpace as they occupy. The exterior face of each of the blades fhould be made round, and divided into two parts, with a longitudinal motion, as in the profile *a a a*, fig. 10.

The axis AB of the roller (fig. 4. and 9.) has two parts perfectly rounded in A and in B, which perform the office of pivots. Thefe pivots reft in the fockets A and B (fig. 8.) in the middle of the levers OAH and OBH. It is by means of thefe levers that they raife at pleafure, or lower the axis of the roller, and fit it exactly, and in a parallel manner, to the plate. The plates (fee fig. 5.) are made of fteel cut into channels, in fuch a manner as to correfpond with the blades of the roller. Their channels are not perpendicular, but oblique; and there are two rows of them, *b x*, *x d*, confifting of feven or eight blades each on one plate.—Thofe in *b x*, for the purpofe of changing the plate, lie in an oppofite direction to thofe in *x d*. The levers are kept in their pofition near the vat by bands of iron, MN and *mn*; between which they are made higher or lower by the cogged wheel H, which fupports one of the extremities. Wedges N *n* are likewife employed to fix the levers at a convenient height above the plates. Finally, Every vat is fupplied with a fmall flide door, which is occafionally raifed to carry

the

the prepared stuff by means of the scuppers of wood to the general repositories.

14 Working of the engine.

Fig. 5. is placed in the vat fig. 8.; the roller (fig. 4.) is placed above it in such a manner that the pivots rest in the sockets of the levers; the scupper (fig. 2.) and the chapiter are disposed in the manner above mentioned. The vat is charged with a proper quantity of rags, and fresh water is admitted by a spigot placed at one of the corners. In this situation, when the engine is put in motion, the roller turning upon its axis draws the water and the rags by the least inclined plane, and making them pass between its blades and the channels of the plate, dashes them against the chapiter and the wicker-frames; and, in short, part of them falls back into the vat, and returns into the circulation. The cause of this circulation is evidently the continual void occasioned by the movement of the roller on the one side, and the return of the water and the stuff on the other.

As all the rags are not thrown towards the part B*d* of the chapiter, from whence they might fall back into the vat, but a part of them to a greater distance; it is necessary to have the wicker frames formerly described, not only to prevent their loss, but to allow the dirty water to escape. The spigot at the corner of the vat continually supplies this waste of water. This operation would be sufficient to whiten the rags, although the rollers were raised considerably from the plate; and therefore the force and action of the rollers reducing them to stuff must be much more effectual. It requires great skill to conduct the engine, whether it be with regard to the first quantity, to the proper time for adding the softer rags, to the augmenting or diminishing the water in proportion to the trituration; or, finally, to knowing exactly when the stuff is reduced to a proper consistency.

In the paper manufactory at Montargis, it was attempted to introduce rollers of the greatest strength and the least weight possible, in order to give them the greater rapidity; but the experiment did not succeed: the rollers of prodigious rapidity were found to produce stuff neither in greater quantity nor of superior quality. The most experienced artists have established a proportion between the motion of the roller and the greater or less resistance of the rags. And the Dutch, who have arrived at very great perfection in this art, have followed a method totally different from that practised at Montargis. A roller in Holland complete in all its parts weighs nearly 30 hundred weight; and they find this necessary for cutting the rags, especially if they have not been putrefied. In proportioning the rapidity to the resistance, they have also discovered, that a slow motion is preferable to a rapid one. The rollers at Saardom, by calculation made from the different parts of the machinery, make about 68 revolutions in a minute; those at Montargis about 166.—In Holland, too, this trituration of the rags is divided into two distinct operations, performed by rollers constructed on different principles: the first of them, for cutting the rags and preparing for the other, is furnished with blades of steel without any moisture, and with a considerable space between them; the second, intended to reduce the stuff to the proper consistency, has a greater number of blades, composed of a mixture of brass and copper. The mills with rollers are in every respect superior to those formerly in use with mallets. Two Dutch rollers of the construction we have just now described will prepare as much stuff in the same time as 24 mallets; they require infinitely less room; they do it without putrefaction, and as they do it in less time, and with less water, they occasion much less waste of the stuff.

When the stuff is brought to perfection, it is conveyed into a general repository, which supplies the vat from which the sheets of paper are formed. This vat is made of wood, and generally about five feet in diameter, and two and a half in depth. It is kept in temperature by means of a grate introduced by a hole, and surrounded on the inside of the vat with a case of copper. For fuel to this grate, they use charcoal or wood; and, frequently, to prevent smoke, the wall of the building comes in contact with one part of the vat, and the fire has no communication with the place where they make the paper.

Every vat is furnished on the upper part with planks, enclosed inwards, and even railed in with wood, to prevent any of the stuff from running over in the operation. Across the vat is a plank which they call the *trapan*, pierced with holes at one of the extremities, and resting on the planks which surround the vat.

The forms or moulds are composed of wire-cloth, and a moveable frame. It is with these that they fetch up the stuff from the vat, in order to form the sheets of paper. The sides of the form are made of oak, which is previously steeped in water, and otherwise prepared to prevent warping. The wire-cloth is made larger than the sheet of paper, and the excess of it on all sides is covered with a moveable frame. This frame is necessary to retain the stuff of which the paper is made on the cloth; and it must be exactly adapted to the form, otherwise the edges of the paper will be ragged and badly finished. The wire-cloth of the form is varied in proportion to the fineness of the paper and the nature of the stuff.

The felts are pieces of woollen cloth spread over every sheet of paper, and upon which the sheets are laid, to detach them from the form, to prevent them from adhering together, to imbibe part of the water with which the stuff is charged, and to transmit the whole of it when placed under the action of the press. The two sides of the felt are differently raised: that of which the hair is longest is applied to the sheets which are laid down; and any alteration of this disposition would produce a change in the texture of the paper. The stuff of which the felts are made should be sufficiently strong, in order that it may be stretched exactly on the sheets without forming into folds; and, at the same time, sufficiently pliant to yield in every direction without injury to the wet paper. As the felts have to resist the reiterated efforts of the press, it appears necessary that the warp be very strong, of combed wool, and well twisted. On the other hand, as they have to imbibe a certain quantity of water, and to return it, it is necessary that the woof be of carded wool, and drawn out into a slack thread.—These are the utensils, together with the press, which are used in the apartment where the sheets of paper are formed.

15 The fabrication of paper.

The vat being furnished with a sufficient quantity of

stuff

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stuff and of water, two instruments are employed to mix them; the one of which is a simple pole, and the other a pole armed with a piece of board, rounded and full of holes. This operation is repeated as often as the stuff falls to the bottom. In the principal writing mills in England, they use for this purpose what is called a *hog*, which is a machine within the vat that, by means of a small wheel on the outside, is made to turn constantly round, and keep the stuff in perpetual motion. When the stuff and water are properly mixed, it is easy to perceive whether the previous operations have been complete. When the stuff floats close, and in regular flakes, it is a proof that it has been well triturated; and the parts of the rags which have escaped the rollers also appear.

After this operation the workman takes one of the forms, furnished with its frame, by the middle of the short sides, and fixing the frame round the wire-cloth with his thumbs, he plunges it obliquely four or five inches into the vat, beginning by the long side, which is nearest to him. After the immersion he raises it to a level: by these movements he fetches up on the form a sufficient quantity of stuff; and as soon as the form is raised the water escapes through the wire-cloth, and the superfluity of the stuff over the sides of the frame. The fibrous parts of the stuff arrange themselves regularly on the wire-cloth of the form, not only in proportion as the water escapes, but also as the workman favours this effect by gently shaking the form. Afterwards, having placed the form on a piece of board, the workman takes off the frame or deckle, and glides this form towards the coucher; who, having previously laid his felt, places it with his left hand in an inclined situation, on a plank fixed on the edge of the vat, and full of holes. During this operation the workman applies his frame, and begins a second sheet. The coucher seizes this instant, takes with his left hand the form, now sufficiently dry, and laying the sheet of paper upon the felt, returns the form by gliding it along the trepan of the vat.

They proceed in this manner, laying alternately a sheet and a felt, till they have made six quires of paper, which is called a *post*; and this they do with such swiftness, that, in many sorts of paper, two men make upwards of 20 posts in a day. When the last sheet of the post is covered with the last felt, the workmen about the vat unite together, and submit the whole heap to the action of the press. They begin at first to press it with a middling lever, and afterwards with a lever about fifteen feet in length. After this operation another person separates the sheets of paper from the felts, laying them in a heap; and several of these heaps collected together are again put under the press.

16 Grain of paper.

The stuff which forms a sheet of paper is received, as we have already said, on a form made of wire-cloth, which is more or less fine in proportion to the stuff, and surrounded with a wooden frame, and supported in the middle by many cross bars of wood. In consequence of this construction, it is easy to perceive, that the sheet of paper will take and preserve the impressions of all the pieces which compose the form, and of the empty spaces between them.

The traces of the wire-cloth are evidently perceived on the side of the sheet which was attached to the form, and on the opposite side they form an assemblage of parallel and rounded risings. As in the paper which is most highly finished the regularity of these impressions is still visible, it is evident that all the operations to which it is submitted have chiefly in view to soften these impressions without destroying them.—It is of consequence, therefore, to attend to the combination of labour which operates on these impressions. The coucher, in turning the form on the felt, flattens a little the rounded eminences which are in relievo on one of the surfaces, and occasions at the same time the hollow places made by the wire-cloth to be partly filled up. Meanwhile the effort which is made in detaching the form, produces an infinite number of small hairs on every protuberant part of the sheet.

Under the action of the press, first with the felts and then without them, the perfecting of the grain of paper still goes on. The vestiges of the protuberances made by the wires are altogether flattened, and of consequence the hollows opposite to them disappear also; but the traces formed by the interstices of the wire, in consequence of their thickness, appear on both sides, and are rounded by the press.

The risings traced on each side of the paper, and which can be discovered by the eye on that which is most highly finished, from what is called the *grain of paper*. The different operations ought to soften but not destroy it; which is effectually done by employing the hammer. This grain appears in the Dutch paper; which is a sufficient proof, that though they have brought this part of the art to the greatest perfection, they have not employed hammers, but more simple and ingenious means. The grain of paper is often disfigured by the felts when they are too much used, or when the wool does not cover the thread. In this case, when the paper is submitted to the press, it takes the additional traces of the warp and the woof, and composes a surface extremely irregular.

The paper, the grain of which is highly softened, is much fitter for the purposes of writing than that which is smoothed by the hammer: on the other hand, a coarse and unequal grain very much opposes the movements of the pen; as that which is beat renders them very uncertain. The art of making paper, therefore, should consist in preserving, and at the same time in highly softening, the grain: the Dutch have carried this to the highest perfection.

17 Exchange.

The exchange succeeds the operation last described. It is conducted in a hall contiguous to the vat, supplied with several presses, and with a long table. The workman arranges on this table the paper, newly fabricated, into heaps; each heap containing eight or ten of those last under the press, kept separate by a woollen felt. The press is large enough to receive two of them at once, placed the one at the other's side. When the compression is judged sufficient, the heaps of paper are carried back to the table, and the whole turned sheet by sheet, in such a manner that the surface of every sheet is exposed to a new one; and in this situation they are again brought under the press. It is in conducting these two operations sometimes to four or five times, or as often as the nature of the paper requires, that the perfection of the Dutch plan consists. If the stuff be fine, or the paper slender, the exchange is less frequently repeated. In this operation

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operation it is neceſſary to alter the ſituation of the heaps, with regard to one another, every time they are put under the preſs; and alſo, as the heaps are higheſt toward the middle, to place ſmall pieces of felt at the extremities, in order to bring every part of them under an equal preſſure. A ſingle man with four or five preſſes may exchange all the paper produced by two vats, provided the previous preſſing at the vats be well performed. The work of the exchange generally laſts about two days on a given quantity of paper.

When the paper has undergone theſe operations, it is not only ſoftened in the ſurface, but better felted, and rendered more pliant in the interior parts of the ſtuff. In ſhort, a great part of the water which it had imbibed in the operation of the vat is diſſipated. By the felting of paper is underſtood the approximation of the fibres of the ſtuff, and their adhering more cloſely together. The paper is felted in proportion as the water eſcapes; and this effect is produced by the management and reiterated action of the preſs. Were it not for the gradual operation of the preſs, the paper would be porous and compoſed of filaments adhering cloſely together. The ſuperiority of the Dutch over the French paper depends almoſt entirely on this operation.

If the ſheets of paper are found to adhere together, it is a proof that the buſineſs of the preſs has been badly conducted. To avoid this inconveniency, it is neceſſary to bring down the preſs at firſt gently, and by degrees with greater force, and to raiſe it as ſuddenly as poſſible. By this means the water, which is impelled to the ſides of the heaps, and which has not yet eſcaped, returns to the centre; the ſheets are equally dry, and the operation executed without difficulty.

According to the ſtate of dryneſs in which the paper is found when it comes from the apartment of the vat, it is either preſſed before or after the firſt exchange. The operation of the preſs ſhould be reiterated and managed with great care; otherwiſe, in the ſoft ſtate of the paper, there is a danger that its grain and tranſparency be totally deſtroyed. Another eſſential principle to the ſucceſs of the exchange is, that the grain of the paper be originally well raiſed. For this purpoſe the wire cloth of the Dutch forms is compoſed of a rounder wire than thoſe uſed in France, by which they gain the greateſt degree of tranſparency, and are in no danger of deſtroying the grain. Beſides this, the Dutch take care to proportion the wires even where the forms are equal to the thickneſs of the paper.

Almoſt every kind of paper is conſiderably improved by the exchange, and receives a degree of perfection which renders it more agreeable in the uſe. But it is neceſſary to obſerve at the ſame time, that all papers are not equally ſuſceptible of this melioration; on the contrary, if the ſtuff be unequal, dry, or weakened by the deſtruction of the fine parts, it acquires nothing of that luſtre and ſoftneſs, and appearance of velvet, which the exchange gives to ſtuffs properly prepared.

18 Of the drying of paper.

The ſheds for drying the paper are in the neighbourhood of the paper mill; and are furniſhed with a vaſt number of cords, up which they hang the ſheets both before and after the ſizing. The ſheds are ſurrounded with moveable lattices, to admit a quantity of air ſufficient for drying the paper. The cords of the ſhed are ſtretched as much as poſſible; and the paper, four or five ſheets of it together, is placed on them by means of a wooden inſtrument reſembling a pickaxe. The principal difficulty in drying the paper, conſiſts in gradually admitting the external air, and in preventing the cords from imbibing moiſture. With regard to the firſt of theſe, the Dutch uſe very low ſheds, and conſtruct their lattices with great exactneſs. By this means the Dutch paper is dried equally, and is extremely ſupple before the ſizing. They prevent the cords from imbibing the water by covering them with wax. In uſing ſuch cords, the moiſture does not continue in the line of contact between the paper and the cord, which prevents the ſheet from ſtretching in that particular place by its weight, and from the folds which the moiſture in the ſubſequent operations might occaſion. The Dutch alſo employ cords of conſiderable thickneſs, and place fewer of them under the ſheets; by which means they diminiſh the points of contact, and give a freer and more equal circulation to the air.

19 Of the ſizing of paper.

The ſize for paper is made of the ſhreds and pairings got from the tanners, curriers, and parchment makers. All the putrified parts and the lime are carefully ſeparated from them, and they are encloſed into a kind of baſket, and let down by a rope and pulley into the cauldron. This is a late invention, and ſerves two valuable purpoſes. It makes it eaſy to draw out the pieces of leather when the ſize is extracted from them by boiling, or eaſy to return them into the boiler if the operation be not complete. When the ſubſtance is ſufficiently extracted, it is allowed to ſettle for ſome time; and it is twice filtered before it is put into the veſſel into which they dip the paper.

Immediately before the operation, a certain quantity of alum is added to the ſize. The workman takes a handful of the ſheets, ſmoothed and rendered as ſupple as poſſible, in his left hand, dips them into the veſſel, and holds them ſeparate with his right, that they may equably imbibe the ſize. After holding them above the veſſel for a ſhort ſpace of time, he ſeizes on the other ſide with his right hand, and again dips them into the veſſel. When he has finiſhed ten or a dozen of theſe handfuls, they are ſubmitted to the action of the preſs. The ſuperfluous ſize is carried back to the veſſel by means of a ſmall pipe. The veſſel in which the paper is ſized is made of copper, and furniſhed with a grate, to give the ſize when neceſſary a due temperature; and a piece of thin board or felt is placed between every handful as they are laid on the table of the preſs.

The Dutch are very careful, in ſizing their paper, to have every ſheet in the ſame handful of equal dryneſs; becauſe it is found that the dry ſheets imbibe the ſize more ſlowly than thoſe which retain ſome degree of moiſture. They begin by ſelecting the *padges* in the drying houſe; and after having made them ſupple, and having deſtroyed the adherence between the ſheets, they ſeparate them into handfuls in proportion to the dryneſs, each of them containing that number which they can dip at one time. Beſides this precaution, they take care to apply two ſheets of brown paper of

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an equal size to every handful. This brown paper, firm, solid, and already sized, is of use to support the sheets.

As soon as the paper is sized, it is the practice of some paper mills to carry it immediately to the drying house, and hang it before it cools sheet by sheet on the cords. The paper, unless particular attention be paid to the lattices of the drying house, is apt to dry too fast, whereby a great part of the size goes off in evaporation; or, if too slow, it falls to the ground. The Dutch drying houses are the best to prevent these inconveniences:—But the exchange after the sizing, which is generally practised in Holland, is the best remedy. They begin this operation on the handfuls of paper, either while they are still hot, or otherwise as they find it convenient. But, after the exchange, they are careful to allow the heaps to be altogether cold before they are submitted to the press. Without this precaution, the size would either be wholly squeezed out by the press of the exchange, or the surface of the paper become very irregular. It is of consequence that the paper, still warm from the sizing, grow gradually firm, under the operation of the exchange, in proportion as it cools. By this method it receives that varnish which is afterwards brought to perfection under the press, and in which the excellency of the paper either for writing or drawing chiefly consists. It is in consequence of the exchanging and pressing that the Dutch paper is soft and equal, and that the size penetrates into the body of it, and is extended equally over its surface.

The exchange after the sizing ought to be conducted with the greatest skill and attention, because the grain of the paper then receives impressions which can never be eradicated. When the sized paper is also exchanged, it is possible to hang more sheets together on the cords of the drying house. The paper dries better in this condition, and the size is preserved without any sensible waste, because the sheets of paper mutually prevent the rapid operation of the external air. And as the size has already penetrated into the paper, and is fixed on the surface, the insensible progress of a well conducted drying house renders all the good effects more perfect in proportion as it is slowly dried.

If to these considerations be added the damage done to the paper in drying it immediately after the press of the sizing room, whether it be done in raising the hairs by separating the sheets, or in cracking the surface, it is evident that the trouble of the second exchange is infinitely overpaid by the advantage.

20
Of the finishing room.

When the paper is sufficiently dry, it is carried to the finishing room, where it is pressed, selected, examined, folded, made up into quires, and finally into reams.—It is here put twice under the press; first, when it is at its full size, and secondly, after it is folded.

The principal labour of this place consists in assorting the paper into different lots, according to its quality and faults; after which it is made up into quires. The person who does this must possess great skill, and be capable of great attention, because he acts as a check on those who separated the paper into different lots. He takes the sheets with his right hand, folds them, examines them, lays them over his left arm till he has the number requisite for a quire, brings the sides parallel to one another, and places them in heaps under the table. An expert workman, if proper care has been taken in assorting the lots, will finish in this manner near 600 quires in a day.

The paper is afterwards collected into reams of 20 quires each, and for the last time put under the press, where it is continued for 10 or 12 hours, or as long as the demand of the paper mill will permit.

21
A new method of bleaching the rags or stuff.

A method has lately been discovered of bleaching the rags or stuff, which will undoubtedly be adopted everywhere in the preparation of writing paper, provided the expence of the process be not too great. This discovery was made by Scheele, M. Berthollet, and M. Chaptal. The first of these illustrious writers communicated to the Swedish Academy of Sciences an Essay on Manganese, containing a numerous series of experiments, intended to investigate the nature and properties of that substance. Among these experiments were several which pointed out a new state of the muriatic acid, or the acid distilled from sea salt, otherwise known under the name of the *acid* or *spirit of sea salt*. This state of the muriatic acid was produced by Mr Scheele, in consequence of putting the said acid into a retort or distilling vessel, along with the above-mentioned substance called *manganese*, and distilling over the acid into a proper receiver; it was found to have changed its nature and properties in a very remarkable manner, while at the same time the manganese remaining in the retort had suffered a very material alteration.

To the new state of the acid thus produced, in consequence of certain theoretic ideas which Mr Scheele entertained respecting the mutual action of the original muriatic acid and the manganese on each other during the process of distillation, he gave the name of *dephlogisticated muriatic acid*. Since the time of this original discovery, in consequence of certain changes which have occurred in the theory or philosophy of chemistry, this new state of the acid of sea salt has been called the *oxygenated muriatic acid*. Among many other properties of it discovered by Mr Scheele, the most remarkable was, that it destroyed the colour of every vegetable substance which was exposed to its action; or, in other words, it bleached them; or, in the language of the dyers, it discharged their colours; that is to say, whatever happened to be the colour of any vegetable body that was submitted to the action of the oxygenated or dephlogisticated muriatic acid, it always became white, or lost its colouring matter.

In the year 1786, Dr Bedoes, now professor of chemistry in the university of Oxford, published an English translation of the Chemical Essays of Mr Scheele; and thereby made known to the chemists of Great Britain the power of the oxygenated or dephlogisticated muriatic acid, to bleach or whiten vegetable substances, or to discharge or decompose their colours. But M. Berthollet, a celebrated chemist in France, and one of the members of the Academy of Sciences at Paris, appears to have been the first who thought of rendering the above recited discovery subservient to the purposes of manufacture.

In 1789, he published in the *Annales de Chimie* an essay calculated entirely for the use of manufacturers, by being divested of theoretic discussions; of which the title is, "Method of bleaching linen or cotton cloths, threads, and yarns, by means of oxygenated muriatic acid, and of some other properties of that liquor which may be useful in manufactures."

Different Kinds of Paper.

In the same work, and in the same year, M. Chaptal, another French chemist, published an account of some experiments, in which, among many other applications of the oxygenated muriatic acid to purposes useful in the economical arts, he gives information of having bleached or whitened coarse rags used by the papermakers, so as greatly to improve the quality of the paper into which they were afterwards manufactured. His preparation of this bleaching liquor differs not from Berthollet's, which is as follows: "Take six ounces of manganese and sixteen ounces of sea salt, both reduced to a fine powder; mix these accurately, and introduce them into a retort or distilling vessel: Then take twelve ounces of oil of vitriol and eight ounces of water, mixed together, and allowed to cool; add these to the other ingredients in the retort, and connect the retort with a cask or receiver capable of holding twenty-seven gallons and a half of water, but only containing twenty-five gallons, which is to be impregnated with the gas or vapour of the oxygenated muriatic acid; and proceed to distillation, first without and afterwards with a fire gradually raised, till the whole acid comes over.

Experiments have been made with this liquor both by some of the principal papermakers in the neighbourhood of Edinburgh and by Messrs Clement and George Taylors of Maidstone in Kent. By the former it was found, that paper made of rags and pulp whitened in this manner, was superior to any other made of similar materials, not only in colour but in fineness of texture. By the latter, the excellence of the liquor was found to be so great, that probably having never heard of Scheele, Berthollet, and Chaptal, and conceiving themselves to be the first inventors of it, they obtained a patent for its exclusive use, which other manufacturers will doubtless disregard. It is not to be concealed, however, that, even with all the precautions which can possibly be taken at first, various circumstances of imperfection must necessarily remain to be removed by means of farther experience, both in the perfection of the bleaching process and the economy of its application to use; but for the attaining of this experience a short time will rarely be sufficient.

## Sect. II. *Of the different Kinds of Paper.*

22 Writing paper.

The paper proper for writing should be without knots, without any parts of the stuff not triturated, without folds, and without wrinkles, of a supple texture, its grain uniform and regular, softened in the exchange, and not destroyed by smoothing. The ground of this paper must be extremely white, or shaded with a very light blue, which adds to its natural splendour. It is of great importance that it be fully and equally sized, otherwise the writing cannot be well finished, and the turnings of the letters will be very imperfect. This paper should be made from stuff not putrefied, which takes a better grain, receives more benefit from the exchange, is more equally sized, and finally, is less subject to folds and wrinkles in the different operations.

23 For durable writing.

To make paper peculiarly fit for durable writing, Dr Lewis recommends the impregnation of it with astringent materials. "It is observable (says he) that writings first begin to fade or change their colour on the back of the paper, where the larger strokes have sunk in, or are visible through it: as if part of the irony matter of the vitriol was in a more subtile or dissolved state than the rest, and sunk further, on account of its not being fully disengaged from the acid, or sufficiently combined with the astringent matter of the galls. Hence, it should seem probable, that if the paper was impregnated with astringent matter, the colour of the ink would be more durable. To see how far this notion was well founded, I dipt some paper in an infusion of galls; and, when dry, repeated the dipping a second and third time. On the paper thus prepared, and some that was unprepared, I wrote with different inks; several of which, that the effects might be more sensible, had an over-proportion of vitriol. The writings being exposed to the weather till the best of the inks on the unprepared paper had faded and changed their colour, those on the prepared paper were all found to retain their blackness. It is therefore recommended to the consideration of the papermakers, whether a particular kind of paper might not be prepared for those uses where the long duration of the writing is of principal importance, by impregnating it with galls or other astringents, in some of the operations it passes through before it receives the glazing; as for instance, by using an astringent infusion, instead of common water, in the last operation, when the matter is reduced into a pulp for being formed into sheets. The brownish hue which the paper receives from the galling, would not perhaps be any great obstacle to its use; and, if the proposal should be thought worthy of being carried into execution, further inquiries may possibly discover the means of obviating the imperfection, and communicating astringency without colour.

24 Paper fit for drawing, or for coloured maps.

The paper used for drawing, or for coloured maps, is in some mills made from one kind of white stuff, either fine or middling; in others, from a mixture of three or four kinds of stuff of different colours. The Dutch were not long ago almost wholly in possession of this manufacture. The same qualities are necessary in this paper as in that for writing. The grain, however, must be a little more raised, although softened by the exchange; for, without this grain, the pencil would leave with difficulty the traces of the objects. Great care is also necessary in the sizing of this paper, that the drawing be neatly performed, and also that the sinking of the ink or colours into the irregularities of the stuff be prevented.

25 Of furniture paper.

This paper is also made in the greatest perfection by stuffs not rotted. These take a more even gloss, and are in better condition to receive all the impressions of the painter. It is also necessary that furniture paper be well softened, and submitted to the exchange, to take more exactly the outlines of the figures. The French have carried this part of the manufacture of paper to the highest state of perfection.

26 Pasteboard used in the manufacture of woollen cloth.

The British and Dutch have had the greatest success in manufacturing pasteboard, which they make either from a single mass of stuff on the form, or from a collection of several sheets pasted together. In both cases, the sheets of pasteboard are made of stuff not rotted, and triturated with rollers furnished with blades of well tempered steel. By the operation of the exchange, and smoothing continued for a long time, the British

Different kinds of Paper. British and Dutch obtain solid and smooth stuffs, which neither break under the folds of cloth nor adhere to them. The stuffs not putrefied have another advantage in this species of pasteboard, namely, that of resisting the action of heat, which they experience between the folds of cloth, without wasting or tarnishing, and of consequence they may be used for a long time.

27 Printing paper. In England they have at least equalled any other nation in the manufacture of this paper; and even in Scotland they have arrived to such a degree of perfection in this art, that great part of what they manufacture is sent into England. It requires to be made of a soft and equal stuff, without folds or wrinkles, of a natural whiteness, and with a shade of blue. It must be sized less strongly than writing paper, but sufficiently well to give neatness to the characters. The paper, thus properly prepared, yields easily to the printing press, and takes a sufficient quantity of ink. The stuff must be without grease, and wrought with that degree of slowness as to make it spread equally over the form, and take a neat and regular grain; without this the characters will not be equally marked in every part of the page; and the smallest quantity of grease renders the sizing unequal and imperfect. Some artists with considerable success, both to meliorate the grain, and to reduce the inequalities of the surface, have submitted this paper to the exchange. And it is proper to add, that a moderate degree of exchanging and of pressing may be of great service after the sheets are printed, to destroy the hollow places occasioned by the press, and the relievo of the letters.

28 Paper for engraving. Engraving requires a paper of the same qualities with the last mentioned, with respect to the stuff, which must be pure, without knots, and equally reduced; the grain uniform, and the sheets without folds or wrinkles. To preserve the grain, it is necessary that it be dried slowly in the lowest place of the drying house. If it is submitted to the exchange, the effects of it must be moderated with the greatest care, and the action of the two first presses must be equally distributed over the whole mass, otherwise the inequality of the moisture at the middle and sides will expose it to wrinkles in the drying. The sizing of this paper must also be moderate. These circumstances are necessary to make it receive with neatness all the soft and delicate touches of the plate. The soft and yielding paper of Auvergne possesses all those advantages; and accordingly a great quantity of this and of printing paper were formerly imported into Britain and Holland from France, where they still continue to rot the materials from which they make engraving paper. The wire-wove frame, though but lately invented, is, we are told, peculiarly adapted to this kind of paper.

29 Paper for cards or any kind of painting on a smooth surface. Paper for cards must be manufactured from a pretty firm stuff, in order to take that degree of smoothness which makes the cards glide easily over one another in using. For this reason the cardmakers reject every kind of paper which is soft and without strength.—This paper requires to be very much sized, since the sizing holds the place of varnish, to which the smoothing gives a glazed and shining surface. To answer all these purposes, the rags require to be a little rotted, and the mallets strongly armed with iron studs. At present Angoumois is almost the only province in France which sells card paper to the Dutch and the other northern nations. The rags of Angoumois have the peculiar quality of not turning too soft in the putrefaction, and the mills of that province reduce them to stuff though they be not much putrefied. The French, we believe, excel every other nation in this branch of the manufacture of paper.

Miscellaneous Observations on Paper.

### Sect. III. *Miscellaneous Observations on Paper.*

30 To preserve paper from sinking. To hinder paper from sinking, take about the size of a nut of rock alum, dissolve it in a glass of clear water, and apply it to the paper, which has not been sufficiently sized, with a fine sponge. It is in this manner that the paper manufacturers of Paris prepare the paper for drawing called *papiers lavés*. When there is occasion to write on a printed book, or on paper too fresh, it is sufficient to mix a little gum with ordinary ink.

31 Paper varnished for writing. To give to writing paper a brilliant varnish, take that which is of an ordinary fineness, very smooth, without any kind of stain or hairs on its surface; stretch it on a smooth plank, and by means of a hare's foot cover it with a thin and equal layer of sandarac finely powdered. Afterwards, if a whole ream is to be varnished, take eight ounces of rock alum and one ounce of white sugarcandy; bring them to boil in six pints of water; and when the liquor is lukewarm, wet that side of the sheet which has been covered with the sandarac with a fine sponge; lay the sheets in a heap, one sheet exactly above another; and submit the ream to the press for the space of twelve hours: hang them afterwards sheet by sheet on the cords of the drying house; put them again under the press for some days to stretch them; and, finally, beat them with a bookbinder's mallet. This paper can only be used for three or four months after it is prepared.

32 Paper prepared for drawing. Painters prepare their paper for drawing, and give it a dark ground, which spares them much labour of the pencil afterwards in those places where shade is necessary. For this purpose, they take white paper and pass a sponge over it, which has imbibed water impregnated with soot, leaving the light places to be formed afterwards. They use also a kind of paper for drawing, which is called tainted paper. A light colour is passed over the whole ground, which deprives the paper of its original brightness, and makes the light places of the print appear more in relievo, and more luminous.

33 Paper prepared for copying a print. The method most common and most convenient for copying a print, is to use oiled paper. The manner of preparing this paper is to take that which is thin and smooth, commonly known by the name of *serpent paper*, and moisten it with a composition, two parts of the oil of walnuts and one part of the oil of turpentine mixed well together. A sheet of pasteboard and a sheet of paper are laid on a smooth table; above them are placed two sheets of paper to be prepared; and a layer of the oil applied to the uppermost is sufficient to penetrate both. This may be done to any number of sheets, and a strong sheet of pasteboard is placed over the whole. The heap is afterwards submitted to the press, under which it remains for two or three days till the oil be completely dry. Paper prepared in this manner serves to copy very readily and

Miscellaneous Observations on Paper.

exactly all kinds of figures and plans; because being altogether transparent, all the parts of the drawing, whether of light or shade, are easily distinguished.

34 Incombustible paper.

Besides the paper made from the asbestos, it is necessary for wrapping up gunpowder and valuable writings, to have a paper that will not easily take fire. The manner in which this is prepared is extremely simple. Ordinary paper is dipped into boiling liquid, consisting of three-fourths of water and one-fourth of dissolved alum. This salt, which is not inflammable, covers the surface of the paper, and renders it in some measure incombustible.

35 A method of erasing ink from paper.

In the season of verjuice, a little of it diluted with water is sufficient for obliterating any fresh spot of ink. The salt of the verjuice dissolved in water answers the purpose equally well, and the salt of the sorrel is also employed, though with less effect. If the spots be dry, and the above acids are insufficint to eradicate them, a little aquafortis diluted in water and applied with the feather of a quill or a fine hair pencil will make them entirely disappear.

36 A method for taking oil stains out of paper.

Books and manuscripts are sometimes defaced by accidental stains with oil. To remove such blemishes, burn sheeps bones and reduce them to a fine powder; lay a quantity of this powder on each side of the stain; place it between two sheets of white paper, and submit it for twelve hours to the press. If the stains have not disappeared, it will be necessary to reiterate the process.

A method of making oiled paper take colours.

To make oiled papers take colours; mix with the colours a very small quantity either of the gall of a pike or carp; and as these substances are of the nature of soap, they dissolve the grease that is in the paper, and permit the colours to be spread over the surface.

38 To make emery paper.

Emery paper, which is employed for taking the rust from iron without wasting it, is made by impregnating coarse paper with gummed water or any other tenacious substance, and then covering it over with the finest emery.

39 Staining or colouring of paper.

The colours proper for paper are not different from those used for other substances, and are enumerated under the article *Colour-Making*. They are applied with soft brushes, after being tempered to a due degree with size or gum water. If the paper on which they are to be laid is soft, so that the colours are apt to go through, it must also be sized before they are laid on, or a proportionably larger quantity must be used along with the colours themselves. If a considerable extent of the paper is to be done over with one colour, it must receive several coatings, as thin as possible, letting each coat dry before another is put on, otherwise the colour will be unequal.

40 To gild paper.

Take yellow ochre, grind it with rain water, and lay a ground with it upon the paper all over; when dry, take the white of eggs, beat it clear with white sugarcandy, and strike it all over: then lay on the leaf-gold; and when dry, polish it with a tooth. Some take saffron, boil it in water, and dissolve a little gum with it; then they strike it over the paper, lay on the gold; and, when dry, they polish it.

41 To silver paper after the Chinese method without silver.

Take two scruples of clear glue made of neats leather, one scruple of white alum, and half a pint of clear water; simmer the whole over a slow fire, till the water is consumed, or the steam ceases: Then, your sheets of paper being laid on a smooth table, you dip a pretty large pencil into that glue, and daub it over as even as you can, repeating this two or three times: then sift the powder of talc through a fine sieve made of horse hair or gauze, over it; and then hang it up to dry; and, when dry, rub off the superfluous talc, which serves again, for the same purpose. The talc you prepare in the following manner: Take fine white transparent Muscovy talc; boil it in clear water for four hours; then take it off the fire, and let it stand so for two days: then take it out, wash it well, and put it into a linen rag, and beat it to pieces with a mallet: to 10 pounds of talc add 3 pounds of white alum, and grind them together in a little hand mill; sift it through a gauze sieve; and being thus reduced to a powder, put it into water, and just boil it up: then let it sink to the bottom, pour off the water from it, place the powder in the sun to dry, and it will become a hard consistence. This beat in a mortar to an impalpable powder, and keep it, for the use above mentioned, free from dust.

42 White and coloured grounds for paper hangings.

The common grounds laid in water are made by mixing whiting with the common glovers size, and laying it on the paper with a proper brush in the most even manner. This is all that is required, where the ground is to be left white; and the paper being then hung on a proper frame till it be dry, is fit to be painted. When coloured grounds are required, the same method must be pursued, and the ground of whiting first laid; except in pale colours, such as straw colours or pink, where a second coating may sometimes be spared, by mixing some strong colour with the whiting.

43 Method of painting the paper hangings.

There are three methods by which paper hangings are painted; the first by *printing* on the colours; the second by using the *stencil;* and the third by laying them on with a *pencil,* as in other kinds of painting.

When the colours are laid on by printing, the impression is made by wooden prints; which are cut in such manner, that the figure to be expressed is made to project from the surface by cutting away all the other part; and this, being charged with the colours tempered with their proper vehicle by letting it gently down on a block on which the colour is previously spread, conveys it from thence to the ground of the paper, on which it is made to fall more forcibly by means of its weight, and the effort of the arm of the person who uses the print. It is easy to conclude, that there must be as many separate prints as there are colours to be printed. But where there are more than one, great care must be taken, after the first, to let the print fall exactly in the same part of the paper as that which went before; otherwise the figure of the design would be brought into irregularity and confusion. In common paper of low price, it is usual, therefore, to print only the outlines, and lay on the rest of the colours by stencilling; which both saves the expence of cutting more prints, and can be practised by common workmen, not requiring the great care and dexterity necessary to the using several prints.

The manner of *stencilling* the colours is this. The figure, which all the parts of any particular colour make in the design to be painted, is to be cut out, in a piece of thin leather or oil cloth, which pieces of leather or oil cloth are called *stencils;* and being laid flat on the sheets

Miscellaneous Observations on Paper.

sheets of paper to be printed, spread on a table or floor, are to be rubbed over with the colour, properly tempered, by means of a large brush. The colour passing over the whole is consequently spread on those parts of the paper where the cloth or leather is cut away, and give the same effect as if laid on by a print. This is nevertheless only practicable in parts where there are only detached masses or spots of colours: for where there are small continued lines, or parts that run one into another, it is difficult to preserve the connexion or continuity of the parts of the cloth, or to keep the smaller corners close down to the paper; and therefore, in such cases, prints are preferable. Stencilling is indeed a cheaper method of ridding coarse work than printing: but without such extraordinary attention and trouble as render it equally difficult with printing, it is far less beautiful and exact in the effect. For the outline of the spots of colour want that sharpness and regularity that are given by prints, besides the frequent extralineations, or deviations from the just figure, which happens by the original misplacing of the stencils, or the shifting the place of them during the operation.

*Pencilling* is only used in the case of nicer work, such as the better imitations of the India paper. It is performed in the same manner as other paintings in water or varnish. It is sometimes used only to fill the outlines already formed by printing, where the price of the colour, or the exactness of the manner in which it is required to be laid on, render the stencilling or printing it less proper; at other times, it is used for forming or delineating some parts of the design, where a spirit of freedom and variety, not to be had in printed outlines, is desired to be had in the work.

44 Management of the flock paper.

The paper designed for receiving the flock is first prepared with a varnish-ground with some proper colour, or by that of the paper itself. It is frequently practised to print some Mosaic, or other small running figure in colours, on the ground, before the flock be laid on; and it may be done with any pigment of the colour desired, tempered with varnish, and laid on by a print cut correspondently to that end.

The method of laying on the flock is this. A wooden print being cut, as is above described, for laying on the colour in such manner that the part of the design which is intended for the flock may project beyond the rest of the surface, the varnish is put on a block covered with leather or oil-cloth, and the print is to be used also in the same manner, to lay the varnish on all the parts where the flocks are to be fixed. The sheet, thus prepared by the varnished impression, is then to be removed to another block or table, and to be strewed over with flock; which is afterwards to be gently compressed by a board, or some other flat body, to make the varnish take the better hold of it: and then the sheet is to be hung on a frame till the varnish be perfectly dry; at which time the superfluous part of flock is to be brushed off by a soft camel's hair brush; and the proper flock will be found to adhere in a very strong manner.

The method of preparing the flock is, by cutting woollen rags or pieces of cloth with the hand, by means of a large bill or chopping knife; or by means of a machine worked by a horse mill.

There is a kind of counterfeit flock paper, which, when well managed, has very much the same effect to the eye as the real, though done with less expence. The manner of making this sort is, by laying a ground of varnish on the paper; and having afterwards printed the design of the flock in varnish, in the same manner as for the true; instead of the flock, some pigment, or dry colour, of the same hue with the flock required by the design, but somewhat of a darker shade, being well powdered, is strewed on the printed varnish, and produces nearly the same appearance.

# PAP PAP

Paper Money.

PAPER *Money* is a term frequently made use of for bank bills, which pass currently in trade instead of gold and silver.

Concerning this species of currency, the national utility of which has been controverted by some, we have the following observations in Dr Smith's Treatise on the Wealth of Nations: "The substitution of paper in the room of gold and silver money replaces a very expensive instrument of commerce with one much less costly, and sometimes equally convenient. Circulation comes to be carried on by a new wheel, which it costs less both to erect and maintain than the old one.

"When the people of any particular country have such confidence in the fortune, probity, and prudence of a particular banker, as to believe that he is always ready to pay upon demand such of his promissory notes as are likely at any time to be presented to him, those notes come to have the same currency as gold and silver money, from the confidence that such money can at any time be had for them.

"A particular banker lends among his customers his own promissory notes, to the amount, we shall suppose, of 100,000l. As those notes serve all the purposes of money, his debtors pay him the same interest as if he had lent them so much money. This interest is the source of his gain. Though some of those notes are continually coming back upon him for payment, part of them continue to circulate for months and years together. Though he has generally in circulation, therefore, notes to the amount of 100,000l. 20,000l. in gold and silver may frequently be a sufficient provision for answering occasional demands. By this operation, therefore, 20,000l. in gold and silver perform all the functions which 100,000l. could otherwise have performed. Eighty thousand pounds of gold and silver can therefore, in this manner, be spared from the circulation of the country; and if different operations of the same kind should at the same time be carried on by many different banks and bankers, the whole circulation may be thus conducted with a fifth part only of the gold and silver.

"Let us, suppose, for example, that the whole circulating money of some particular country amounted, at a particular time, to 1,000,000l. sterling, that sum being

being then sufficient for circulating the whole annual produce of their land and labour. Let us suppose too, that, some time thereafter, different banks and bankers issued promissory notes, payable to the bearer, to the extent of 1,000,000l. reserving in their different coffers 200,000l. for answering occasional demands. There would remain, therefore, in circulation 800,000l. in gold and silver, and 1,000,000l. of bank notes, or 1,800,000l. of paper and money together. But the annual produce of the land and labour of the country had before required only 1,000,000l. to circulate and distribute it to its proper consumers, and that annual produce cannot be immediately augmented by those operations of banking. One million, therefore, will be sufficient to circulate it after them. The goods to be bought and sold being precisely the same as before, the same quantity of money will be sufficient for buying and selling them. The channel of circulation, if I may be allowed such an expression, will remain precisely the same as before. One million we have supposed sufficient to fill that channel. Whatever, therefore, is poured into it beyond this sum, cannot run in it, but must overflow. One million eight hundred thousand pounds are poured into it. Eight hundred thousand pounds, therefore, must overflow, that sum being over and above what can be employed in the circulation of the country. But though this sum cannot be employed at home, it is too valuable to be allowed to lie idle. It will therefore be sent abroad, in order to seek that profitable employment which it cannot find at home. But the paper cannot go abroad; because, at a distance from the banks, which issue it, and from the country in which payment of it can be exacted by law, it will not be received in common payments. Gold and silver, therefore, to the amount of 800,000l. will be sent abroad, and the channel of home circulation still remain filled with 1,000,000l. of paper instead of 1,000,000l. of those metals which filled it before.

"But though so great a quantity of gold and silver is thus sent abroad, we must not imagine that it is sent abroad for nothing, or that its proprietors make a present of it to foreign nations. They will exchange it for foreign goods of some kind or another, in order to supply the consumption either of some other foreign country or of their own.

"If they employ it in purchasing goods in one foreign country in order to supply the consumption of another, or in what is called the *carrying trade*, whatever profit they make will be an addition to the neat revenue of their own country. It is like a new fund, created for carrying on a new trade; domestic business being now transacted by paper, and the gold and silver being converted into a fund for this new trade.

"If they employ it in purchasing foreign goods for home consumption, they may either first purchase such goods as are likely to be consumed by idle people who produce nothing, such as foreign wines, foreign silks, &c.; or, secondly, they may purchase an additional stock of materials, tools, and provisions, in order to employ an additional number of industrious people, who reproduce, with a profit, the value of their annual consumption.

"So far as it is employed in the first way, it promotes prodigality, increases expence and consumption, without increasing production, or establishing any permanent fund for supporting that expence, and is in every respect hurtful to the society.

"So far as it is employed in the second way, it promotes industry; and though it increases the consumption of the society, it provides a permanent fund for supporting that consumption, the people who consume, reproducing, with a profit, the whole value of their annual consumption. The gross revenue of the society, the annual produce of their land and labour, is increased by the whole value which the labour of those workmen adds to the materials upon which they are employed; and their neat revenue by what remains of this value, after deducting what is necessary for supporting the tools and instruments of their trade.

"That the greater part of the gold and silver which, being forced abroad by those operations of banking, is employed in purchasing foreign goods for home consumption, is and must be employed for purchasing those of this second kind, seems not only probable, but almost unavoidable. Though some particular men may sometimes increase their expence very considerably, though their revenue does not increase at all, we may be assured that no class or order of men ever does so; because, though the principles of common prudence do not always govern the conduct of every individual, they always influence that of the majority of every class or order. But the revenue of idle people, considered as a class or order, cannot in the smallest degree be increased by those operations of banking. Their expence in general, therefore, cannot be much increased by them, though that of a few individuals among them may, and in reality sometimes is. The demand of idle people, therefore, for foreign goods, being the same, or very nearly the same, as before, a very small part of the money, which being forced abroad by those operations of banking, is employed in purchasing foreign goods for home consumption, is likely to be employed in purchasing those for their use. The greater part of it will naturally be destined for the employment of industry, and not for the maintenance of idleness.

"When we compute the quantity of industry which the circulating capital of any society can employ, we must always have regard to those parts of it only which consist in provisions, materials, and finished work: the other, which consists in money, and which serves only to circulate those three, must always be deducted. In order to put industry into motion, three things are requisite; materials to work upon, tools to work with, and the wages or recompense for the sake of which the work is done. Money is neither a material to work upon, nor a tool to work with; and though the wages of the workman are commonly paid to him in money, his real revenue, like that of all other men, consists, not in the money, but in the money's worth; not in the metal pieces, but in what can be got for them.

"The quantity of industry which any capital can employ, must evidently be equal to the number of workmen whom it can supply with materials, tools, and a maintenance suitable to the nature of the work. Money may be requisite for purchasing the materials and tools of the work, as well as the maintenance of the workmen. But the quantity of industry which the whole capital can employ, is certainly not equal both

to

to the money which purchases, and to the materials, tools, and maintenance, which are purchased with it; but only to one or other of those two values, and to the latter more properly than to the former.

"When paper is substituted in the room of gold and silver money, the quantity of the materials, tools, and maintenance, which the whole circulating capital can supply, may be increased by the whole value of gold and silver which used to be employed in purchasing them. The whole value of the great wheel of circulation and distribution is added to the goods which are circulated and distributed by means of it. The operation, in some measure, resembles that of the undertaker of some great work, who, in consequence of some improvement in mechanics, takes down his old machinery, and adds the difference between its price and that of the new to his circulating capital, to the fund from which he furnishes materials and wages to his workmen.

"What the proportion is which the circulating money of any country bears to the whole value of the annual produce circulated by means of it, it is perhaps impossible to determine. It has been computed by different authors at a fifth, at a tenth, at a twentieth, and at a thirtieth part of that value. But how small soever the proportion which the circulating money may bear to the whole value of the annual produce, as but a part, and frequently but a small part, of that produce, is ever destined for the maintenance of industry, it must always bear a very considerable proportion to that part. When, therefore, by the substitution of paper, the gold and silver necessary for circulation is reduced to perhaps a fifth part of the former quantity, if the value of only the greater part of the other four fifths be added to the funds which are destined for the maintenance of industry, it must make a very considerable addition to the quantity of that industry, and consequently to the value of the annual produce of land and labour.

"That part of his capital which a dealer is obliged to keep by him unemployed, for answering occasional demands, is so much dead stock, producing nothing either to him or to his country. The judicious operations of banking enable him to make it active and productive. The gold and silver money which circulates in any country, and by means of which the produce of its land and labour is annually circulated and distributed to the proper consumers, is, in the same manner as the ready money of the dealer, all dead stock. It is a very valuable part of the capital of the country, which produces nothing to the country. The judicious operations of banking, by substituting paper in the room of a great part of it, enables the country to make a great part of this dead stock active and productive. The gold and silver money which circulates in any country, may very properly be compared to a highway, which, while it circulates and carries to market all the grass and corn of the country, produces itself not a single pile of either. The judicious operations of banking, by providing, If I may be allowed so violent a metaphor, a sort of waggon way through the air, enable the country to convert, as it were, a great part of its highways into good pastures and corn fields, and thereby to increase very considerably the annual produce of its land and labour. The commerce and industry of the country, however, it must be acknowledged, though they may be somewhat augmented, cannot be altogether so secure, when they are thus, as it were, suspended upon the Dædalian wings of paper money, as when they travel about upon the solid ground of gold and silver.



"The whole paper money of every kind which can easily circulate in any country, never can exceed the value of the gold and silver, of which it supplies the place, or which (the commerce being supposed the same) would circulate there if there was no paper money. If twenty shilling notes, for example, are the lowest paper money current in Scotland, the whole of that currency, which can easily circulate there, cannot exceed the sum of gold and silver which would be necessary for transacting the annual exchanges of twenty shillings value and upwards, usually transacted within that country. Should the circulating paper at any time exceed that sum, as the excess could neither be sent abroad, nor be employed in the circulation of the country, it must immediately return upon the banks to be exchanged for gold and silver. Many people would immediately perceive that they had more of this paper than was necessary for transacting their business at home, and as they could not send it abroad, they would immediately demand payment of it from the banks. When this superfluous paper was converted into gold and silver, they could easily find a use for it by sending it abroad; but they could find none while it remained in the shape of paper. There would immediately, therefore, be a run upon the banks to the whole extent of this superfluous paper, and if they showed any difficulty or backwardness in payment, to a much greater extent; the alarm which this would occasion necessarily increasing the run." See BANK and TRADE.

PAPER *Office*, an office in the palace of Whitehall, in which all the public writings, matters of state and council, proclamations, letters, intelligences, negotiations abroad, and generally all despatches that pass through the offices of the secretaries of state, are lodged, by way of library.

PAPIER MACHE. This is a substance made of cuttings of white or brown paper, boiled in water, and beaten in a mortar, till they are reduced into a kind of paste, and then boiled with a solution of gum arabic or of size, to give tenacity to the paste, which is afterwards formed into different toys, &c. by pressing it into oiled moulds. When dry, it is done over with a mixture of size and lamp black, and afterwards varnished. The black varnish for these toys, according to Dr Lewis, is prepared as follows: some colophony, or turpentine boiled down till it becomes black and friable, is melted in a glazed earthen vessel, and thrice as much amber in fine powder sprinkled in by degrees, with the addition of a little spirit or oil of turpentine now and then: when the amber is melted, sprinkle in the same quantity of sarcocolla, continuing to stir them, and to add more spirit of turpentine, till the whole becomes fluid; then strain out the clear through a coarse hair bag, pressing it gently between hot boards. This varnish, mixed with ivory black in fine powder, is applied, in a hot room, on the dried paper paste; which is then set in a gently heated oven, next day in a hotter oven, and the third day in

a very hot one, and let stand each time till the oven grows cold. The paste thus varnished is hard, durable, glossy, and bears liquors hot or cold.

PAPHLAGONIA (anc. geog. a country of the Hither Asia, beginning at Parthenius, a river of Bithynia, on the west, and extending in length to the Halys eastward, with the Euxine to the north, and Galatia to the south. Pliny enlarges the limits on the west side to the river Billis, on this side the Parthenius. It is called *Pylæmenia* by some (Pliny). *Paphlagones*, the people, mentioned by Homer, and therefore of no small antiquity. A superstitious and silly people (Lucian); a brave people (Homer); taking their name from Phaleg (Bochart).

PAPHOS (anc. geog.), two adjoining islands on the west side of the island of Cyprus; the one called *Hale Paphos* (Strabo, Ptolemy, Pliny); the other *Nea Paphos*; and when mentioned without an adjunct, this latter is always understood. Both dedicated to Venus, and left undistinguished by the poets (Virgil, Horace). Hence Venus is surnamed *Paphia*. *Paphii*, the people, (Coins, Stephanus). It was restored by Augustus, after a shock of an earthquake, and called *Augusta* (Dio).

The Abbé Mariti, in his Travels through Cyprus, gives the following account of the island of Paphos. "It is situated (says he) on the southern side: it contained the celebrated temple of Venus; which, together with the city, was destroyed by an earthquake, so that the least vestige of it is not now to be seen. A lake in the neighbourhood, which even in summer overflows with stagnant and corrupted water, renders the air in some degree unwholesome. On the western coast is the new Paphos, called by some of the modern geographers *Baffos*; a name which is unknown in the island of Cyprus. That we may not positively ascribe to the latter every thing that history tells us of Paphos in general, it may not be here improper to mention that it has been several times destroyed. This city had a port, where vessels trading upon that coast still cast anchor: but this happens only in summer; for, being exposed to every wind, it is extremely dangerous. The bottom of it is full of sharp rocks; which sometimes destroy the cables so much, that mariners are obliged to keep them afloat on the surface of the water, by means of empty casks fixed to them at certain distances. In the neighbourhood there are two castles; one on the borders of the sea, and the other on the summit of a little hill: but the latter is at present in ruins. The government of Paphos consists of a digdaban or commissary; a cadi; and an aga, who presides over the customhouse Of all the Christian edifices, there is none remaining but the church of St George, in which service is performed by the Greek ministers. The productions of this part of the island, which are all of an excellent quality, are silk, barley, and other kinds of grain. To discover the origin of the Old and New Paphos, would be carrying light into the midst of the thickest darkness. When we have added conjecture to conjecture, we are still in the same situation. As this is an attempt superior to my abilities, I shall leave it to the divining, though uncertain, knowledge of our antiquaries. I must, however, observe, that there was here formerly a temple dedicated to Venus, which was entirely destroyed by an earthquake. In this island St Paul by his eloquence converted Sergius, a Roman proconsul. He here likewise conferred the deaconship on his disciple and colleague Titus, who soon after suffered martyrdom. Paphos was an episcopal city in the time of the Lusignans; and it is still the seat of a bishop, who is a suffragan to the archbishop of Nicosia. On the western side of the island there are a great number of scattered villages; but they are not worthy of notice, being either abandoned or in ruins."





Mr Bruce informs us, that in the neighbourhood of this place many silver medals of excellent workmanship are dug up; they are, however, but of little estimation among the antiquarians, being chiefly of towns of the size of those found at Crete and Rhodes, and in all the islands of the Archipelago. There are some excellent Greek intaglios; generally upon better stones than usual in the islands. This illustrious traveller informs us, that he has seen some heads of Jupiter, remarkable for bushy hair and a beard, which were of excellent workmanship, and worthy of any price. All the inhabitants of the island are subject to fevers, but especially those in the neighbourhood of Paphos. The same traveller observes, that Cyprus was very long undiscovered; for though ships had been sailing on the Mediterranean 1700 years before Christ, and though the island is only a day's sailing from the continent of Asia on the north and east, and little more from that of Africa on the south, it was not known at the building of Tyre, a little before the Trojan war, that is, 500 years after the neighbouring seas had been navigated. It was covered with wood at its first discovery; and our author is of opinion, that it was not well known even at the time of building of Solomon's temple; because we do not find that Hiram king of Tyre, though just in its neighbourhood, ever had recourse to it for wood: though the carriage would undoubtedly have been easier from thence, than to have brought it down from the top of Mount Lebanon. Eratosthenes informs us, that in ancient times the island was so overgrown with wood, that it could not be tilled; so that they first cut down the timber to be used in the furnaces for melting silver and copper; that after this they built fleets with it: but finding even this insufficient, they gave liberty to all strangers to cut it down for whatever purpose they pleased; and not only so, but they gave them afterwards the property of the ground they had cleared. Matters are now quite altered; and the want of wood is a principal complaint in most parts of the island. About Acamas, however, on the west side of the island, the wood is still thick and impervious, inhabited by large stags and wild boars of a monstrous size. Mr Bruce was informed, that a live elephant had lately been seen there, but gave no credit to the account.

PAPIAS, bishop of Hieropolis, a city of Phrygia, was the disciple of St John the Evangelist, and the companion of Polycarp, as St Jerome observes, and not of John the Ancient, as some other authors have maintained. He composed a work in five books, entitled *Expositions of the Discourses of our Lord*, of which there are only some fragments now remaining. He it was who introduced the opinion of the Millenarians.

PAPILIO, the BUTTERFLY, in zoology; a genus of insects belonging to the order of lepidoptera. It has

Papilio.

has four wings, imbricated with kind of downy ſcales; the tongue is convoluted ſpiral form; and the body is hairy. The antennæ grow thicker towards their extremity, and are in moſt ſubjects terminated by a kind of capitulum or head. The wings when ſitting, are erect, inſomuch that their extremities meet or touch one another above the body. They fly in the day time. There are 273 ſpecies, principally diſtinguiſhed by the colour of their wings. Mr Barbut has divided them into four ſections, which he thus characterizes. 1. The equites, or riders, the upper wings being longer from the hindermoſt angle to the point than to the baſe; their antennæ are often filiform. They are divided into Trojans; which for the moſt part are black, with bloodlike ſpots on the breaſt; and Greeks, whoſe breaſts have no ſuch marks; the ſmall eye being placed at the angle of the anus; and of theſe ſome are without bands or fillets, others with bands or fillets. 2. The heliconians, whoſe wings are narrow throughout, often bare; the upper oblong, the under ones very ſhort. 3. The Danai, whoſe wings are entire; the candidi, with whitiſh wings; the feſtivi, with variegated wings. 4. The nymphals, whoſe wings are denticulated: divided into the gemmati whoſe wings have eyes; ſubdivided into thoſe who have eyes on all the wings; thoſe which have them on the upper wings; thoſe which have them on the under ones; and the phalerati, whoſe wnigs are without eyes. 5. The plebeians, whoſe larva is often contracted; divided into the rurales, with darkiſh ſpots on their wings; and the urbicolæ, with ſpots generally tranſparent on their wings.

*Barbut on Inſects.*

The beauties of this elegant part of the creation are well known; and there are few who can contemplate them without aſtoniſhment. We have the following account of their various ſtages of exiſtence in Barbut†. "The caterpillar (ſays he) informs us in what manner it prepares for the lethargic ſleep, which is to ſerve as a tranſition to its metamorphoſis. The period of its reptile life being accompliſhed, it changes its form to become an inhabitant of the air. The chryſalis is at once the tomb of the caterpillar and the cradle of the butterfly. It is within a ſilken cod, or under a tranſparent veil, that this great miracle of nature is daily wrought; but how does the weak defenceleſs butterfly ſcarce unfolded into exiſtence, go about to make its way through the impenetrable walls that preſerved it from inſult during its torpid ſtate? How will it bear the effulgence of the light, and keenneſs of the air? Take one of their cods, make an aperture in it with a pair of ſciſſars, fix it againſt a glaſs; obſerve the inſect, you will perceive the organs gradually diſplaying themſelves: follow his operation with your eye; he ſtruggles to break looſe from his confinement. Obſerve the frothy liquor that it diſgorges; that liquor tends to ſoften the end of the cod, which at length yields to the butting of the inſect's head. By degrees the bar is removed, and the butterfly ſprings forth; the impreſſion of the air acts upon its wings, ſlightly apparent at firſt, but which afterwards expand with remarkable rapidity. The diſplay of them is ſometimes checked by drought, in which caſe the inſect is deprived of the faculty of flying. The roſtrum, extended under the covering of the chryſalis is in this laſt ſtate rolled up into a ſpiral, and lodged in a receſs prepared for it. The fly is now perfectly formed; it gently flutters, then takes its flight, and purſues its mazy wanderings over the enamelled meads, plunging its roſtrum into the cups of nectareous flowers."

† *Ibid.*

Of papilio, N° 1. Barbut gives the following account. "The ground colour of the inſect is a beautiful gloſſy black, the ſuperior wings are ornamented with white forked clouds; the inferior ones are adorned with ſpots of a blood colour, thoſe neareſt the xtremities being of a lunular form, and are indented, terminating in an extended tail, and are edged with white. The apex, or crown of the head, is tipt with the ſame red colour which encircles the ſhoulders, and terminates the abdomen the ſpace of about five rings."

Plate CCCLXXIV.

Of N° 2. he ſpeaks thus: "The form of the wings reſembles the preceding inſects. They are beautifully variegated with black and yellow; the inferior ones terminate in a tail, and according to the character of the ſection are adorned with an eye of a yellowiſh red colour, encircled with blue, which is ſituated at the edge, neareſt the extremity of the abdomen. This is the largeſt, and one of the moſt beautiful inſects England produces. The caterpillar is large and ſmooth, of a bright green colour, with tranſverſal bands, of a deep gloſſy purple upon every ring, which bands are enriched with yellow ſpots; it feeds on wild fennel and other umbelliferous plants; changes to the chryſalis in July, aſſumes the winged ſtate in Auguſt, and frequents meadows. It ſometimes appears in May."

And of N° 3. we have this account: "The peacock, or peacock's eye, is eaſily known by the peacock's eyes which it bears above, four in number, one upon each wing which hath given it the name it has. Its wings, very angulous, are black underneath; above they are of a reddiſh dun colour. The upper ones have on their ſuperior edge two black oblong ſpots, with a yellow one between the two. At their extremity is found the eye, large, reddiſh in the middle, ſurrounded with a yellow circle accompanied by a ſmall portion of blue towards the exterior ſide. On that ſame ſide following the direction of the margin, there are five or ſix white ſpots, ſet in order. The inferior wings are browner, and have each a large eye of a very dark blue in the middle, ſurrounded by an aſh-coloured circle. The caterpillar of this butterfly is of a deep black, dotted with a little white."

We cannot conclude this article without noticing ſome very ſingular ſpecies; of which Mr Reaumur has given an account, and which deſerve particular regard.

One ſpecies of theſe he has called the *bundle of dry leaves*. This, when it is in a ſtate of reſt, has wholly the appearance of a little cluſter of the decayed leaves of ſome herb. The poſition and colour of its wings greatly favour this reſemblance, and they have very large ribs; wholly like thoſe of the leaves of plants, and are indented in the ſame manner at their edges as the leaves of many plants are. This ſeems to point out the care of nature for the animal, and frequently may preſerve it from birds, &c.

The ſkull butterfly is another ſingular ſpecies, ſo called from its head reſembling in ſome degree a death's head or human ſkull. This very remarkable appearance is terrible to many people; but it has another yet greater ſingularity attending it, which is,

that, when frighted, it has a mournful and harsh voice. This appeared the more surprising to Mr Reaumur, as no other known butterfly had the least voice at all; and he was not ready of belief that it was a real voice, but suspected the noise, like that of the cicadæ, to be owing to the attrition of some part of the body; and, in fine, he, by great pains, discovered that this noise was not truly vocal, but was made by a hard and brisk rubbing of the trunk against two other hard bodies between which it is placed.

Another butterfly there is, so small that it might be mistaken for a small fly. This is certainly the extreme in degree of size of all the known butterflies, and cannot but have been proportionably small in the state of a caterpillar and chrysalis: this creature spends its whole life in all the three stages of caterpillar, chrysalis, and butterfly, on the leaf of the celandine. It lives on the under side of the leaf; and though in the caterpillar state it feeds on it, yet it does no damage. It does not eat the substance of the leaf, but draws from it only a fine juice, which is soon repaired again, without occasioning any change in the appearance of the leaf. This species is very short lived; and passes through its three states in so short a time, that there are frequently ten generations of it in one year; whereas, in all the other butterflies, two generations in the year are all that are to be had. These two generations are sufficient to make a prodigious increase: in a large garden, if there are twenty caterpillars in spring, these may be overlooked, and there may be easily concluded to be none there, even on a narrow search; but if these twenty caterpillars afterwards become twenty butterflies, ten of which are male and ten female, and each female lay the same number of eggs that the common silk worm does, that is, four hundred; if all the caterpillars hatched of these become butterflies, and these lay eggs in the same proportion, which remain the winter, and come to be hatched in the succeeding spring; then from these twenty, in only one year, you will have eight hundred thousand; and if we add to this the increase of these in a succeeding year, the account must appear terrible, and such as no art could guard against. The great Ruler of the world has put so many hinderances in the way of this over abundant production, that it is very rare such years of destruction happen. Some such have happened, however; and much mischief has been dreaded from them, not only from their eating all the herbage, but from themselves being eaten with herbs in sallads and otherwise: but experiments have proven this to be an erroneous opinion, and they are found to be innocent, and eatable as snails or oysters.

PAPILIONACEOUS, among botanists, an appellation given to the flowers of plants belonging to various classes, from their resembling the wings of a butterfly.

PAPINIAN, a celebrated Roman lawyer of the third century, under the emperor Severus; who had so high an opinion of his worth, that he recommended his sons Caracalla and Geta to his care. Caracalla having first murdered his brother, ordered Papinian to compose a discourse to excuse this murder to the senate and people; which when he refused to undertake, the brutal emperor ordered him to be beheaded; and his body was dragged through the streets of Rome. Papinian wrote several treatises in the line of his profession.



PAPISTS, are those who believe the pope or bishop of Rome to be the supreme pastor of the universal church, who profess to believe all the articles of Pope Pius's creed, and who promise implicit obedience to the edicts of the church, especially the decrees of the council of Trent. See POPE and TRENT.

PAPPENHEIM, a town of Germany, in the circle of Franconia, and capital of a county of the same name, with a castle, where the counts reside. It is seated near the river Altmal, 17 miles north-west of Neuburg, and 32 south of Nuremburg; and is subject to its own count. E. Long. 10. 51. N. Lat. 48. 58. The count of Pappenheim is hereditary marshal of the empire, and performs his office at the coronation of the emperor.

PAPPUS, an eminent philosopher of Alexandria, said by Suidas to have flourished under the emperor Theodosius the Great, who reigned from A. D. 379 to 395. His writings show him to have been a consummate mathematician: Many of them are lost; the rest continued long in manuscript, detached parts having only been occasionally published in the last century, until Carolus Manolessius published his remains entire at Bologna in 1660, in folio.

PAPPUS, in botany, a soft downy substance that grows on the seeds of certain plants, as thistles, hawkweed, &c. serving to scatter and buoy them up in the air.

PAPYRUS, the famous reed from which was made the far-famed paper of Egypt. Before entering on the description of the papyrus, it is natural to say a word or two on the opinion generally received in Europe concerning the loss of this plant. Supposing this loss possible, the date of it must be fixed at no distant period; for it is not 200 years since Guillandin and Prosper Alpin observed the papyrus on the banks of the Nile. Guillandin saw the inhabitants of the country eating the inferior and succulent part of the stem in the manner of the ancients; a fact which alone shows it to be the papyrus, and of which other travellers seem not to have availed themselves. This practice, together with those related by Prosper Alpin, are sufficient to convince us, that this plant is not wholly useless, although it is not now employed in the fabrication of paper. The alteration on the soil of Egypt, and on the methods of agriculture, have in all probability rendered this plant less common; but causes altogether local could not occasion the destruction of the papyrus, especially as its residence in the marshes would prevent their operation. But it is needless to reason from probabilities or analogy: Mr Bruce not only saw the papyrus growing both in Egypt and Abyssinia, but actually made paper of it, in the manner in which it was made by the ancients. He tells us likewise, that, so far from any part of it being useless, the whole plant is at this day used in Abyssinia for making boats, a piece of the acacia-tree being put in the bottom to serve as a keel. That such were the boats of ancient Egypt, we know from the testimony of Pliny, who informs us, that the plants were first sewed together, and then gathered up at stem and stern, and tied fast to the keel: "Conseritur bibula Memphitis cymba papyro."

*Appendix to Bruce's Travels.*

"The bottom, root, or woody part of this plant was likewise of several uses before it turned absolutely hard; it was chewed in the manner of liquorice, having a considerable quantity of sweet juice in it. This we learn from Dioscorides; it was, I suppose, chewed, and the sweetness sucked out in the same manner as is done with sugar cane. This is still practised in Abyssinia, where they likewise chew the root of the Indian corn, and of every kind of cyperus: and Herodotus tells us, that about a cubit of the lower part of the stalk was cut off, and roasted over the fire, and eaten.

"From the scarcity of wood, which was very great in Egypt, this lower part was likewise used in making cups, moulds, and other necessary utensils: we need not doubt, too, one use of the woody part of this plant was, to serve for what we call *boards* or *covers* for binding the leaves, which were made of the bark; we know that this was anciently one use of it, both from Alcæus and Anacreon."

The papyrus, says Pliny, grows in the marshes of Egypt, or in the stagnant places of the Nile, made by the flowing of that river, provided they are not beyond the depth of two cubits. Its roots are tortuous, and in thickness about four or five inches: its stem is triangular, rising to the height of ten cubits. Prosper Alpin gives it about six or seven cubits above the water; the stem tapers from the bottom, and terminates in a point. Theophrastus adds, that the papyrus carries a top or plume of small hairs, which is the thyrsus of Pliny. Guillandin informs us, that its roots throw to the right and left a great number of small fibres, which support the plant against the violence of the wind, and against the waters of the Nile. According to him, the leaves of the plant are obtuse, and like the typha of the marshes. Mr Bruce, on the other hand, assures us, that it never could have existed in the Nile. "Its head (says he) is too heavy; and in a plain country the wind must have had too violent a hold of it. The stalk is small and feeble, and withal too tall; the root too short and slender to stay it against the violent pressure of the wind and current; therefore I do constantly believe it never could be a plant growing in the river Nile itself, or in any very deep or rapid river;" but in the calishes or places where the Nile had overflowed and was stagnant.

The Egyptians made of this plant paper fit for writing (see PAPER), which they call βιβλος or *philuria*, and also χαρτης, and hence the Latin *charta*; for in general the word *charta* is used for the paper of Egypt.

The papyrus was produced in so great quantities on the banks of the Nile, that Cassiodorus (lib. xi. 38.) compares it to a forest. There, says he, rises to the view, this forest without branches, this thicket without leaves, this harvest of the waters, this ornament of the marshes. Prosper Alpin is the first who gives us a plate of the papyrus, which the Egyptians call *berdi*. However badly this may be executed, it corresponds in some degree with the description of the plant mentioned by Theophrastus; but by much the best drawing of it has been given by Mr Bruce, who has very obligingly permitted us to give a copy of it. See Plate CCCLXXV.

The ancient botanists placed the papyrus among the graminous plants or dog grass; ignorant of the particular kind to which it belonged, they were contented to specify it under the name of *papyrus*, of which there were two kinds, that of Egypt, and that of Sicily. The moderns have endeavoured to show, that these two plants are one and the same species of cyperus. It is under this genus that they are found in the catalogues and descriptions of plants published since the edition of Morrison's work, where the papyrus is called *cyperus niloticus vel Syriacus maximus papyraceus*.



In the manuscripts of the letters and observations of M. Lippi physician at Paris, who accompanied the envoy of Louis XIV. to the emperor of Abyssinia, we find the description of a cyperus which he had observed on the banks of the Nile in 1704. After having described the flowers, he says that many ears covered with young leaves are supported by a pretty long pedicle; and that many of those pedicles, equally loaded and coming from one joint, form a kind of parasol. The disk of this parasol is surrounded with a quantity of leaves which form a crown to the stem which supports it. The stem is a pretty long prism, the corners of which are a little rounded; and the leaves, not at the top but at the side, are formed like the blade of a sword; the roots are black and full of fibres; and this plant is called *cyperus Nileacus major, umbella multiplici*.

The same Lippi describes another kind which rises not so high: the stem and leaves correspond with the former, but the ears form rather a kind of head than any thing like the spreading of an umbrella; this head was very soft, shining, and gilded rich and airy, much loaded, supported by pedicles which were joined together at the bottom like the knitting of a parasol. It is called by him *cyperus Nileacus major aurea, divisa pannicula*. These two kinds of cyperus have a marked resemblance in their leaves, their stem, their foliage, and the marshy places where they grow. The only difference consists in their size, and in the position of the ears, which serve to distinguish them; and they seem to bear a resemblance to the papyrus and the sari, described by ancient authors. The first is perhaps the papyrus, and the second the sari; but this is only conjecture.

The papyrus, which grew in the waters, is said to have produced no seed; but this Mr Bruce very properly calls an absurdity. "The form of the flower (says he) sufficiently indicates, that it was made to resolve itself into the covering of one, which is certainly very small, and by its exalted situation and thickness of the head of the flower, seems to have needed the extraordinary covering it has had to protect it from the violent hold the wind must have had upon it. For the same reason, the bottom of the filaments composing the head are sheathed in four concave leaves, which keep them close together, and prevent injury from the wind getting in between them." Its plume was composed of slender pedicles, very long, and somewhat like hair, according to Theophrastus. The same peculiarity exists in the papyrus of Sicily; and the same is found to exist in another kind of papyrus sent from Madagascar by M. Poivre, correspondent of the Academy of Sciences.

It is impossible to determine whether the papyrus of Sicily was used in any way by the Romans. In Italy it is called *papero*, and, according to Cesalpin, *pipero*.



This

Papyrus. This papyrus of Sicily has been cultivated in the garden of Pisa; and if we can depend on the authority of Cesalpin, who himself examined the plant, it is different from the papyrus of Egypt.

The papyrus, says he, which is commonly called *pipero* in Sicily, has a longer and thicker stem than the plant cyperus. It rises sometimes to four cubits; the angles are obtuse, and the stem at the base is surrounded with leaves growing from the root; there are no leaves on the stem even when the plant is at the greatest perfection, but it carries at the top a large plume which resembles a great tuft of dishevelled hairs; this is composed of a great number of triangular pedicles, in the form of reeds; at the extremity of which are placed the flowers, between two small leaves of a reddish colour like the cyperus. The roots are woody, about the thickness of reeds, jointed, and they throw out a great number of branches which extend themselves in an oblique direction. These are scented somewhat like the cyperus, but their colour is a lighter brown; from the lower part issue many small fibres, and from the higher a number of stems shoot up, which in proportion as they are tender contain a sweet juice.

The plume of the papyrus of Sicily is pretty well described in a short account of it in the second part of the *Musæum de Boccone*. This plume is a tuft or assemblage of a great number of long slender pedicles, which grow from the same point of division, are disposed in the manner of a parasol, and which carry at the top three long and narrow leaves, from which issue other pedicles, shorter than the former, and terminating in several knots of flowers. Micheli, in his *Nova Plantarum Genera*, printed at Florence 1728, has given an engraving of one of the long pedicles in its natural length: it is surrounded at the base with a case of about one inch and a half in height; towards the extremity it carries three long and narrow leaves, and four pedicles, to which are fixed the knots of flowers. Every pedicle has also a small case surrounding its base. In short, we find in the *Grosto Graphia* of Schenchzer a very particular description of the plume of a kind of cyperus, which appears to be the Sicilian plant. From this account it appears that the papyrus of Sicily is well known to botanists. It were to be wished that we had as particular a description of the papyrus of Egypt; but meanwhile it may be observed, that these two plants have a near affinity to one another; they are confounded together by many authors; and according to Theophrastus, the *sari* and the *papyrus nilotica* have a decided character of resemblance, and only differ in this, that the papyrus sends forth thick and tall stems, which being divided into slender plates, are fit for the fabrication of paper; whereas the sari has small stems, considerably shorter, and altogether useless for any kind of paper.

The papyrus, which served anciently to make paper, must not be confounded with the papyrus of Sicily, found also in Calabria; for, according to Srabo, the papyrus was to be found in no place excepting Egypt and India. The greatest part of botanists have believed that the Sicilian plant is the same with the sari of Theophrastus; others have advanced that the papyrus of Egypt and the sari were the same plant in two different stages of its existence, or considered with respect to the greater or less height, which, according to them, might depend on the qualities of the soil, the difference of the climate, or other accidental causes. In proof of this, it is maintained, that there is an essential difference between the papyrus growing in the waters and the same plant growing on the banks of rivers and in marshes. The first of these have thick and tall stems, and a plume in the form of a tuft of hair very long and slender, and without any seed: the second differs from the first in all these particulars; it has a shorter and more slender stem, its plume is loaded with flowers, and of consequence it produces seed. In whatever way we consider these facts, it is sufficient for us to know, that the difference between the papyrus and the sari neither depends on climate, nor soil, nor on situation. The plants whose difference depended on these circumstances, both grew in Egypt, and were both employed in the manufacture of paper. But it is an established fact, that the sari cannot be employed for this purpose.

Finally, The papyrus of Sicily began to be known by botanists in 1570, 1572, 1583, at which periods the works of Lobel, of Guillandin, and of Cesalpin, first appeared. The ancients had no manner of knowledge of this plant. Pliny makes no mention of it in his Natural History; from which it is evident that it was neither used in Rome nor in Sicily. If he had seen this plant, he must have been struck with its resemblance to the papyrus and the sari, as they were described by Theophrastus; and since he gives a particular description of these last mentioned, he would have most naturally hinted at their conformity to the Sicilian papyrus.

Among many dried plants collected in the East Indies by M. Poivre, there is a kind of papyrus very different from that of Sicily. It carries a plume composed of a considerable tuft of pedicles, very long, weak, slender, and delicate, like single threads, terminating most frequently in two or three small narrow leaves, without any knot of flowers between them; hence this plume must be altogether barren. Those pedicles or threads are furnished with a pretty long membranous case, in which they are inserted; and they issue from the same point of direction, in the manner of a parasol. The plume, at its first appearance, is surrounded with leaves like the radii of a crown. The stem which supports it is, according to M. Poivre, about ten feet in height, where there is two feet under water; it is of a triangular form, but the angles are rounded; its thickness is about the size of a walking staff which fills the hand.

The interior substance, although soft and full of fibres, is solid, and of a white colour. By this means the stem possesses a certain degree of strength, and is capable of resistance. It bends without breaking; and as it is extremely light, it serves in some sort for a cane. The same M. Poivre used no other during a residence of several months at Madagascar. This stem is not of equal thickness in its whole length; it tapers insensibly from the thickest part towards the top. It is without knots, and extremely smooth. When this plant grows out of the waters, in places simply moist, it is much smaller, the stems are lower, and the plume is composed of shorter pedicles or threads, terminating at the top in three narrow leaves, a little longer than those

*Papyrus* Plate CCCLXXV.

*J. & H. Bindall al. sculptor fecit.*

those at the plume, when the plant grows in the water. From the base of these leaves issue small knots of flowers, arranged as they are in the cyperus; but these knots are not elevated above the pedicles, they occupy the centre of the three leaves, between which they are placed, and form themselves into a small head. The leaves which spring from the root and the lower part of the stem resemble exactly those in the cyperus. This plant, which the inhabitants call *sanga-sanga*, grows in great abundance in their rivers and on their banks, but particularly in the river Tartas, near the Foule-point in Madagascar. The inhabitants of these cantons use the bark of this plant for mats; they make it also into sails, into cordage for their fishing houses, and into cords for their nets.

This kind of papyrus, so lately discovered, and different from the papyrus of Sicily by the disposition of its flowers, shows, that there are two kinds of the cyperus which might easily be confounded with the papyrus of Egypt; whether we consider, on the one hand, to what purposes the inhabitants of the places where they grow have made them subservient; or, on the other compare their form, their manner of growth, and the points in which they resemble each other. This comparison can be easily made from the accounts which Pliny and Theophrastus gave of the papyrus of Egypt, and by the figure and description given by Prosper Alpin, after having observed the plant on the banks of the Nile. But if we can depend on the testimony of Strabo, who affirms that the papyrus is found nowhere but in Egypt and in India, it is perhaps possible that the papyrus of the isle of Madagascar is the same with that of Egypt.

Whatever truth may be in this conjecture, the inhabitants of this island have never derived from it those advantages which have immortalized the papyrus of Egypt. They have not made that celebrated paper, *quo usu maxime humanitas, vita, constat et memoria.* This remarkable expression of Pliny not only characterizes the Egyptian paper, but every kind which art and industry have substituted in its place.

PAR, in commerce, signifies any two things equal in value. See EXCHANGE.

PARABLE, a fable or allegorical instruction, founded on something real or apparent in nature or history, from which a moral is drawn by comparing it with something in which the people are more immediately concerned; such are the parables of Dives and Lazarus, of the Prodigal Son, of the Ten Virgins, &c. Dr Blair observes, that "of parables, which form a part of allegory, the prophetical writings are full; and if to us they sometimes appear obscure, we must remember, that in those early times it was universally the mode throughout all the eastern nations to convey sacred truths under mysterious figures and representations."

PARABOLA. See *Conic Sections*.

PARABOLE. See ORATORY, N° 84.

PARACELSUS (Aurelius Philip Theophrastus Bombastus de Hohenheim), a famous physician, born at Einsidlen, a town in the canton of Schweitz in Swisserland. He was educated with great care by his father, who was the natural son of a prince, and in a little time made a great progress in the study of physic. He afterwards travelled into France, Spain, Italy, and Germany, in order to become acquainted with the most celebrated physicians. At his return to Swisserland, he stopped at Basil, where he read lectures on physic in the German tongue. He was one of the first who made use of chemical remedies with success, by which he acquired a very great reputation. Paracelsus gloried in destroying the method established by Galen, which he believed to be very uncertain; and by this means drew upon himself the hatred of the other physicians. It is said, that he boasted of being able, by his remedies, to preserve the life of man for several ages: but he himself experienced the vanity of his promises, by his dying at Saltzburg, in 1504, at 37 years of age according to some, and at 48 according to others. The best edition of his works is that of Geneva in 1658, in 3 vols. folio.



PARACENTESIS, an operation in surgery, commonly called *tapping*. See SURGERY.

PARACLET, the COMFORTER, a name given to the Holy Ghost.

PARADE, in a military sense, the place where troops assemble or draw together, to mount guard, or for any other purpose.

PARADE, in fencing, implies the action of parrying or turning off any thrust.

PARADIS (Francis Augustine) de MONCRIF. See MONCRIF.

PARADISE, a term principally used for the garden of Eden, in which Adam and Eve were placed immediately upon their creation.

As to this terrestrial paradise, there have been many inquiries about its situation. It has been placed in the third heaven, in the orb of the moon, in the moon itself, in the middle region of the air, above the earth, under the earth, in the place possessed by the Caspian sea, and under the arctic pole. The learned Huetius places it upon the river that is produced by the conjunction of the Tigris and Euphrates, now called the *river of the Arabs*, between this conjunction and the division made by the same river before it falls into the Persian sea. Other geographers have placed it in Armenia, between the sources of the Tigris, the Euphrates, the Araxes, and the Phasis, which they suppose to be the four rivers described by Moses. But concerning the exact place we must necessarily be very uncertain, if indeed it can be thought at all to exist at present, considering the many changes which have taken place on the surface of the earth since the creation.

"Learned men (says Mr Miln *) have laboured to find out the situation of Paradise, which seems to be but a vague and uncertain inquiry; for the Mosaic description of it will not suit any place on the present globe. He mentions two rivers in its vicinity, *viz.* Pison and Gihon, of which no vestiges can now be found. The other two still remain, *viz.* the Hiddekel, supposed to be the Tigris, and the Euphrates, whose streams unite together at a considerable distance above the Persian gulf; in some part of which, it is highly probable the happy garden once lay (A). This gulf

* *Physico Theol. Lectures.*

(A) "*God* (we are told) *placed at the east of the garden of Eden cherubims and a flaming sword, which turned every*

 is eastward both of the land of Midian and the wilderness of Sinai; in one of which places Moses wrote his history. But since the formation of this earth, it has undergone great changes from earthquakes, inundations, and many other causes. The garden, however, seems to have been a peninsula, for the way or entrance into it is afterwards mentioned. We are told that a 'river went out of it;' which, according to some, should be rendered 'run on the outside of it,' and thus gave it the form of a horse-shoe: for had the Euphrates run through the middle of the garden, one half of it would have been useless to Adam, without a bridge or boat wherewith to have crossed it."

The learned authors of the Universal History, in their account of rarities natural and artificial in Syria, mention "a spot which is still shown as the place where once stood the garden of Eden, or Terrestrial Paradise. And indeed it is in all respects so beautiful and rich, and yields so delightful a prospect from the adjacent hills, that there is hardly another place in the world that has a fairer title to the name it bears. Its proximity to Damascus, the capital of Syria, near the fountain head of the Jordan; its situation between the Tigris or Hiddekel, the Euphrates, the Phasis or Phison, the Araxes or Gihon (which last has those names from its vast rapidity above all other known rivers), its bordering upon the land of Chus, famed for its fine gold; all these and many other marks specified by Moses, together with its charming and surprising fruitfulness, and constant verdure, have induced a great number of commentators to settle that celebrated and so much sought-after spot here, and to deem it the most valuable of all the natural rarities of this country."

Christians, however, need not be told, that however curious or amusing this inquiry may be, the determination of it is of no importance, since we are all well assured that the celestial paradise is that place of pure and refined delight in which the souls of the blessed enjoy everlasting happiness.

It may not be improper, however, in this place to give a description of the paradise of the Mohammedans. The sensuality and absurdity of that impostor must be apparent to all men. Their religion has no consistency in its parts, and the descriptions of the future enjoyments of the faithful are miserable instances of human weakness and folly.

"The paradise of the Mohammedans is said by them to be situated above the seven heavens, or in the seventh, and next under the throne of God; and to express the amenity of the place, they tell us that the earth of it is of the finest wheat flour, or of the purest musk, or of saffron; and that its stones are pearls and jacinths, the walls of its buildings enriched with gold and silver, and the trunks of all its trees of gold, amongst which the most remarkable is the tree *tuba*, or tree of happiness. They pretend that this tree stands in the palace of Mohammed, though a branch of it will reach to the house of every true believer, loaded with pomegranates, dates, grapes, and other fruits of surprising bigness, and delicious tastes, unknown to mortals. If a man desires to eat of any particular kind of fruit, it will immediately be presented to him; or if he chooses flesh, birds ready dressed will be set before him, and such as he may wish for. They add, that this tree will supply the blessed, not only with fruit, but with silk garments also, and beasts to ride on, adorned with rich trappings, all which will burst forth from the fruit; and that the tree is so large, that a person mounted on the fleetest horse would not be able to gallop from one end of its shade to the other in 100 years. Plenty of water being one of the greatest additions to the pleasantness of any place, the Alcoran often speaks of the rivers of paradise as the principal ornament. Some of these rivers are said to flow with water, some with milk, some with wine, and others with honey: all of them have their sources in the root of this tree of happiness; and, as if these rivers were not sufficient, we are told that the garden of this paradise is also watered by a great number of lesser springs and fountains, whose pebbles are rubies and emeralds, their earth of camphor, their beds of musk, and their sides of saffron. But all those glories will be eclipsed by the resplendent and exquisite beauty of the girls of paradise, the enjoyment of whose company will constitute the principal felicity of the faithful. These (they say) are not formed of clay, as mortal women, but of pure musk; and are, as their prophet often affirms in his Alcoran, free from all the natural defects and inconveniences incident to the sex. Being also of the strictest modesty, they keep themselves secluded from public view in pavilions of hollow pearls, so large, that, as some traditions have it, one of them will be no less than 16, or, as others say, 60 miles long, and as many broad. With these the inhabitants of paradise may taste pleasures in their height; and for this purpose will be endowed with extraordinary abilities, and enjoy a perpetual youth."

*Paradise Lost*, the name of a modern epic poem, the first and finest of those composed by Milton.

The subject of this poem is extraordinary; it had never before been attempted, and seemed to be above the efforts of human genius. Angels and devils are not the machinery, but the principal actors in it; so that what would appear marvellous in any other composition, is in this only the natural course of events.—The poet's intention was, as he expresses it himself, to vindicate the ways of God to men. How far Milton was happy in the choice of his subject, may be questioned,

*every way, to keep the way of the tree of life.* In Scripture, the extraordinary judgments of God are said to be executed by his angels, who are sometimes compared to flames of fire. Therefore the cherubim and the flaming sword may probably mean nothing more than that a large portion of ground on the eastward of Paradise was set on fire during the above awful occasion, and continued burning with such violence, that the flame thereof at a distance appeared like a brandished sword, turning every way with the wind. Now if the soil of Eden was bituminous, like that of Gomorrah (which was once so fertile as to be compared to the "garden of the Lord"), the fire would continue burning till it produced the same effect in the one place as it did in the other, and turned a great part of that tract into sea: which seems to countenance the opinion of those who place the situation of Paradise in some part of the Persian gulf."

questioned. It has led him into difficult ground, though it certainly suited the daring sublimity of his genius. It is a subject for which he alone was fitted; and, in the conduct of it, he has shown a stretch both of imagination and invention which is perfectly wonderful.

*Bird of Paradise*. See the following article.

Plate CCCLXXIV. PARADISEA, in ornithology; a genus of birds belonging to the order of picæ. The beak is covered with a belt or collar of downy feathers at the base; and the feathers on the sides are very long.

"Birds of this genus (says Latham) have the bill slightly bending; the base covered with velvet-like feathers. The nostrils are small, and concealed by the feathers. The tail consists of 10 feathers; the two middle ones, and sometimes more in several of the species, are very long, and webbed only at the base and tips. The legs and feet are very large and strong: they have three toes forward, one backward, and the middle connected to the outer one as far as the first joint. The whole of this genus have, till lately, been very imperfectly known; few cabinets possessing more than one species, viz. the Greater, or what is called the *common bird of Paradise*; nor has any set of birds given rise to more fables, the various tales concerning which are to be found in every author; such as, their never touching the ground from their birth to death; living wholly on the dew; being produced without legs; and an hundred such stories, too ridiculous even to mention. This last error is scarcely at this moment wholly eradicated. The circumstance which gave rise to it did not indeed at first proceed from an intention to deceive, but merely from accident. In the parts of the world which produce these birds, the natives made use of them as *aigrets*, and other ornaments of dress; and in course threw away the less brilliant parts. The whole trouble they were at on this occasion, was merely to skin the bird, and, after pulling off the legs, coarser parts of the wings, &c. thrust a stick down the throat into the body, letting an inch or two hang out of the mouth, beyond the bill; on the bird's drying, the skin collapsed about the stick which became fixed, and supported the whole. They had then no more to do than to put this end of it into a socket fitted to receive it, or fasten it in some manner to the turban, &c. By degrees these were imported into the other isles for the same uses, and afterwards were coveted by the Japanese, Chinese, and Persians, in whose countries they are frequently seen, as well as in many parts of India; the grandees of these last parts not only ornamenting themselves with these beautiful plumes, but adorning even their horses with the same."

The Portuguese first found these birds on the island of Gilolo, the Papua islands; and New Guinea; and they were known by the name of *birds of the sun*. The inhabitants of Ternate call them *manuco dewata*, the "bird of God:" whence the name *manuco diata*, used by some naturalists, is derived. According to some fabulous accounts, this bird has no legs, lives constantly on wing, and in the air; and, in confirmation of these accounts, the legs of all the dead birds offered to sale were cut off. But the inhabitants of Aroo, who resort yearly to Banda, undeceived the Dutch, and freed them from those prejudices. Another reason for cutting off the legs is, that the birds are more easily preserved without them; besides that the Moors wanted the birds without legs, in order to put them on in their mock fights as ornaments to their helmets. The inhabitants of Aroo, however, have brought the birds with legs for 80 or 90 years; and Pijafetta, shipmate of Ferdinand Magellan, proved, about the year 1525, an eye witness that these creatures were not without legs. However, the peculiar length and structure of their scapular feathers hinders them from settling, in high winds, on trees; and when they are thrown on the ground by these winds, they cannot rise again. If taken by the natives, they are immediately killed, as their food is not known; and they defend themselves with great courage with their formidable bills.

Latham enumerates eight species, but suspects there may be more. We shall satisfy ourselves with the following:

1. The largest bird of Paradise is commonly two feet four inches in length; the head is small; the bill hard and long, of a pale colour. The head and back part of the neck is lemon coloured, a little black about the eyes; about the neck, the bird is of the brightest glossy emerald green, soft like velvet; as is also the breast, which is black: the wings are large, and chesnut coloured; the back part of the body is covered with long, straight, narrow feathers, of a pale brown colour, similar to the plumes of the ostrich. These feathers are spread when the bird is on the wing; for which reason he can keep very long in the air. On both sides of the belly are two tufts of stiff and shorter feathers, of a golden yellow, and shining. From the rump proceed two long stiff shafts, which are feathered on their extremities.

These birds are not found in Key, an island fifty Dutch miles east of Banda; but they are found at the Aroo islands, lying 15 Dutch miles farther east than Key, during the westerly or dry monsoon; and they return to New Guinea as soon as the easterly or wet monsoon sets in. They come always in a flock of 30 or 40, and are led by a bird which the inhabitants of Aroo call the *king*. This leader is black, with red spots; and constantly flies higher than the rest of the flock, which never forsake him, but settle as soon as he settles: a circumstance that frequently proves their ruin when the king lights on the ground, whence they are not able to rise on account of the singular structure and disposition of their plumage. They are likewise unable to fly with the wind, which would ruin their loose plumage; but take their flight constantly against it, cautious not to venture out in hard blowing weather, as a strong wind frequently obliges them to come to the ground. During their flight they cry like starlings. Their note, however, approaches more to the croaking of ravens; which is heard very plainly when they are in distress from a fresh gale blowing on the back of their plumage. In Aroo, these birds settle on the highest trees, especially on the ficus benjamina of the hortus malabaricus, commonly called the *waringa tree*. The natives catch them with birdlime or in nooses, or shoot them with blunt arrows; but though some are still alive when they fall into their hands, the catchers kill them immediately, and sometimes cut the legs off; then they draw out the entrails, dry and fumigate the bodies

 dies with sulphur or smoke only, and sell them at Banda for half a rixdollar each; but at Aroo they may be bought for a spike-nail or a piece of old iron. Flocks of these birds are often seen flying from one island to the other against the wind. In case they find the wind become too powerful, they fly straight up into the air, till they come to a place where it is less agitated, and then continue their flight. During the eastern monsoon their tails are moulted, so that they have them only during four months of the western monsoon.

2. The smaller bird of Paradise is about 20 inches long. His beak is lead-coloured, and paler at the point. The eyes are small, and enclosed in black about the neck. The head and back of the neck are of a dirty yellow; the back of a grayish yellow; the breast and belly of a dusky colour; the wings small, and chesnut-coloured. The long plumage is about a foot in length, and paler than in the large species; as in general the colours of this bird are less bright than the former. The two long feathers of the tail are constantly thrown away by the natives. This is in all respects like the greater sort; and they likewise follow a king or leader, who is, however, blacker, with a purplish cast, and finer in colour than the rest. The neck and bill are larger in the male than in the female. They roost on the tops of the highest trees, and do not migrate like the other kind. Some say, that the birds of this species, finding themselves weak through age, soar straight towards the sun till they are tired, and fall dead to the ground. The natives draw the entrails, sear the birds with a hot iron, and put them in a tube of bamboo for preservation.

3. and 4. The large black bird of Paradise is brought without wings or legs for sale; so that no accurate description of it hath yet been given. Its figure, when stuffed, is narrow and round, but stretched in length to the extent of four spans. The plumage on the neck, head, and belly, is black and velvet-like, with a hue of purple and gold, which appears very strong. The bill is blackish, and one inch in length. On both sides are two bunches of feathers, which have the appearance of wings, although they be very different, the wings being cut off by the natives. This plumage is soft, broad, similar to peacocks feathers, with a glorious gloss and greenish hue, and all bent upwards; which Valentine thinks is occasioned by the birds being kept in hollow bamboo-reeds. The feathers of the tail are of unequal length; those next to the belly are narrow, like hair; the two uppermost are much longer, and pointed; those immediately under them are a span and a half longer than the upper ones; they are stiff, on both sides fringed with a plumage like hair, black above, but glossy below. Birds of this kind are brought only from one particular place of New Guinea. Besides the large black bird of Paradise, there is still another sort, whose plumage is equal in length, but thinner in body, black above, and without any remarkable gloss, not having those shining peacock feathers which are found on the greater species. This wants likewise the three long pointed feathers of the tail belonging to the larger black species.

5. The white bird of Paradise is the most rare, and has two varieties; one quite white, and the other black and white. The former is very rare. The second has the fore part black, and the back part white; with 12 crooked wiry shafts, which are almost naked, tho' in some places, covered with hairs. 

6. In the year 1689 a new species of the black bird of paradise was seen in Amboyna. This was only one foot in length, with a fine purple hue, a small head, and a straight bill. On its back, near the wings, are feathers of a blue and purple colour, as on the other birds of Paradise; but under the wings and over all the belly they are yellow coloured, as in the common sort: on the back of the neck they are mouse-coloured mixed with green. It is remarkable in this species, that there are before the wings two roundish tufts of feathers, which are green-edged, and may be moved at pleasure by the bird, like wings. Instead of a tail, he has 12 or 13 black, naked, wire-like shafts, hanging promiscuously like feathers. His legs are strong, and have sharp claws. The head is remarkably small; and the eyes are also small, and surrounded with black.

7. The last species we shall mention is the king's bird. This creature is about seven inches long, and somewhat larger than a titmouse. Its head and eyes are small; the bill straight; the eyes included in circles of black plumage; the crown of the head is flame-coloured; the back of the neck blood-coloured; the neck and breast of a chesnut colour, with a ring of the brightest emerald-green. Its wings are in proportion strong; and the quill-feathers dark, with red shining plumes, spots, and stripes. The tail is straight, short, and brown. Two long naked black shafts project from the rump, at least a hand-breadth beyond the tail; having at their extremities semilunar twisted plumage, of the most glaring green colour above, and dusky below. The belly is white and green sprinkled; and on each side is a tuft of long plumage, feathered with a broad margin, being on one side green and on the other dusky. The back is blood-red and brown, shining like silk. The legs are in size like those of a lark, three fore toes and one back toe. This bird associates not with any of the other birds of Paradise; but flits solitary from bush to bush, wherever he sees red berries, without ever getting on tall trees.

Those who wish for minuter information respecting this curious genus, we must refer to Latham's Synopsis, and Buffon's Birds, Vol. IX. &c.

PARADOX, παραδοξον, in philosophy, a proposition seemingly absurd, as being contrary to some received opinions, but yet true in fact.

The vulgar and illiterate take almost every thing, even the most important, upon the authority of others, without ever examining it themselves. Although this implicit confidence is seldom attended with any bad consequences in the common affairs of life, it has nevertheless, in other things, been much abused; and in political and religious matters has produced fatal effects. On the other hand, knowing and learned men, to avoid this weakness, have fallen into the contrary extreme: some of them believe every thing to be unreasonable, or impossible, that appears so to their first apprehension; not adverting to the narrow limits of the human understanding, and the infinite variety of objects, with their mutual operations, combinations, and affections, that may be presented to it.

It

Plate CCCLXXIV

Paradox. It must be owned, that credulity has done much more mischief in the world than incredulity has done, or ever will do; because the influences of the latter extend only to such as have some share of literature, or affect the reputation thereof. And since the human mind is not necessarily impelled, without evidence, either to belief or unbelief, but may suspend its assent to, or dissent from, any proposition till after a thorough examination; it is to be wished that men of learning, especially philosophers, would not hastily, and by first appearances, determine themselves with respect to the truth or falsehood, possibility or impossibility, of things.

A person who has made but little progress in the mathematics, though in other respects learned and judicious, would be apt to pronounce it impossible that two lines, which were nowhere two inches asunder, may continually approach towards one another, and yet never meet, though continued to infinity: and yet the truth of this proposition may be easily demonstrated. And many, who are good mechanics, would be as apt to pronounce the same, if they were told, that though the teeth of one wheel should take equally deep into the teeth of three others, it should affect them in such a manner, that, in turning it any way round its axis, it should turn one of them the same way, another the contrary way, and the third no way at all.

No science abounds more with paradoxes than geometry: thus, that a right line should continually approach to the hyperbola, and yet never reach it, is a true paradox; and in the same manner a spiral may continually approach to a point, and yet not reach it in any number of revolutions, however great.

The Copernican system is a paradox to the common people; but the learned are all agreed as to its truth. Geometricians have of late been accused of maintaining paradoxes; and some do indeed use very mysterious terms in expressing themselves about asymptotes, the sums of infinite progressions, the areas comprehended between curves and their asymptotes, and the solids generated from these areas, the length of some spirals, &c. But all these paradoxes and mysteries amount to no more than this; that the line or number may be continually acquiring increments, and those increments may decrease in such a manner, that the whole line or number shall never amount to a given line or number. The necessity of admitting it is obvious from the nature of the most common geometrical figures: thus, while the tangent of a circle increases, the area of the corresponding sector increases, but never amounts to a quadrant. Neither is it difficult to conceive, that if a figure be concave towards a base, and have an asymptote parallel to the base (as it happens when we take a parallel to the asymptote of the logarithmic curve, or of the hyperbola, for a base), that the ordinate in this case always increases while the base is produced, but never amounts to the distance between the asymptote and the base. In like manner, a curvilinear area may increase while the base is produced, and approach continually to a certain finite space, but never amount to it; and a solid may increase in the same manner, and yet never amount to a given solid. See *M'Laurin's Fluxions*. See LOGARITHMIC *Curve*.

Paradoxi || Paraguay.

PARADOXI, a sort of mimes or buffoons among the ancients, who entertained the people with extempore effusions of drollery. They were also called *Paradoxologi*, *Ordonarii*, *Neanicologi*, and *Aretalogi*. See MIMI.

PARAGAUDÆ, among the Romans, were wreaths of gold, or silk and gold, interwoven in, not sewed to their garments. The garment was sometimes of one colour, with one paragaudæ; sometimes of two colours, with two paragaudæ; of three colours, with three paragaudæ, &c. They were worn both by men and women.

PARAGOGE, in grammar, a figure whereby a letter or syllable is added to the end of a word; as *med*, for *me*; *dicier*, for *dici*, &c.

PARAGRAPH, in general, denotes a section or division of a chapter; and in references is marked thus, ¶.

PARAGUAY, or LA PLATA, a province of Spanish America, bounded on the north by the river of the Amazons; on the east, by Brazil; on the south, by Patagonia; and on the west, by Chili and Peru. This country was first discovered by Sebastian Cabot, who, in 1526, passed from Rio de la Plata to the river Parana in small barks, and thence entered the river called *Uruguay*. It was not, however, thoroughly reduced till the Jesuits obtained possession of it. A few of these went to Paraguay soon after the city of Assumption was founded, and converted about 50 Indian families, who soon induced many others to follow their example, on account of the peace and tranquillity they enjoyed under the fathers. They had long resisted the Spaniards and Portuguese; but the Jesuits, by learning their language, conforming to their manners, &c. soon acquired great authority among them; till at last, by steadily pursuing the same artful measures, they arrived at the highest degree of power and influence, being in a manner the absolute sovereigns of a great part of this extensive country; for above 350,000 families are said to have been subject to them, living in obedience and awe bordering on adoration, yet procured without the least violence or constraint.

We have the following particular account of the missions of Paraguay, in the words of Don Jorge Juan, &c. *Gent. Mag. 1753.* "The territories of the missions of Paraguay comprehended not only the province of that name, but also a great part of the provinces of Santa Cruz de la Sierra, Tucuman, and Buenos Ayres. The temperature (A) of the air is good, though somewhat moist, and in some parts rather cold: the soil in many places is fertile;



(A) The climate of Paraguay differs but little from that of Spain; and the distinctions between the seasons are much the same. In winter, indeed, violent tempests of wind and rain are very frequent, accompanied with such dreadful claps of thunder and lightning as fill the inhabitants, though used to them, with terror and consternation. In summer, the excessive heats are mitigated by gentle breezes, which constantly begin at eight or nine in the morning.

Paraguay. tile (B); and produces in great abundance not only the fruits and vegetables peculiar to America, but alſo thoſe of Europe which have been introduced there. The chief articles of their commerce are cotton, tobacco, ſome ſugar, and the herb called *Paraguay*. Every town gathers annually more than 2000 arrobas of cotton, of a quarter of an hundred weight each, which the Indians manufacture into ſtuffs. There are alſo great quantities of tobacco produced. But the chief article is the herb Paraguay: for it grows only in the diſtricts of the miſſions; and there is a vaſt conſumption of this herb in all the provinces of Chili and Peru, eſpecially of that called *camini*, which is the pure leaf; the infuſion of which is called *mate*, and is drank by the inhabitants of Lima twice a day in lieu of tea or chocolate. The mate which is made by the infuſion of the ſtalk is not ſo much eſteemed.

"'Tis now almoſt two centuries ſince theſe miſſions were firſt ſet on foot by the Jeſuits. The bad management of the Portugueſe greatly favoured the views of theſe fathers. There was a nation of Indians called *Guaranies*, ſome whereof were ſettled upon the banks of the rivers Uruguay and Parana, and others a hundred leagues higher up in the country to the north-weſt of Guayra. The Portugueſe frequently came upon them, and by force carried away as many as they thought proper to their plantations, and made ſlaves of them. Offended by ſuch treatment, the Guaranies reſolved to quit their ſettlements in the neighbourhood of the Portugueſe, and to remove into the province of Paraguay. Accordingly a migration of 12,000 perſons great and ſmall, enſued. Theſe the Jeſuits ſoon converted; and having had the like ſucceſs in converting about an equal number of the natives of Tape, a diſtrict in Paraguay, they united the two nations, and laid the foundation of their future dominion. Theſe fathers ſeem to have trode in the ſteps of the firſt Incas, and to have civilized nations and converted ſouls in order to acquire ſubjects. According to a very exact account taken in the year 1734, there were then 32 towns of the Guaranies, which were reckoned to contain above 30,000 families; and as the new converts were continually increaſing, they were then about laying the foundations of three new towns. There were alſo then ſeven very populous towns inhabited by the converted Chiquito Indians, and they were preparing to build others for the reception of the new converts of that nation which were daily made.

"The miſſions of Paraguay are ſurrounded on all ſides with wild or unconverted Indians; ſome of whom live in friendſhip with the towns, but others haraſs them by frequent incurſions. The father miſſionaries frequently viſit theſe Indians, and preach to them; and from theſe expeditions they ſeldom return without bringing along with them ſome new converts to incorporate with their civilized ſubjects. In the performance of this duty they ſometimes penetrate 100 leagues into thoſe uncultivated tracts where wild Indians range; and it is obſerved that they meet with the leaſt ſucceſs amongſt thoſe nations with whom any fugitive Meſtizos, or Spaniſh criminals, have taken refuge. The diligence of theſe fathers is certainly worthy the imitation of the Proteſtant clergy.

"Every town has its curate, who is aſſiſted by one, and very often by two prieſts of the ſame order, according to the largeneſs and extent of the town and its diſtrict. Theſe two or three prieſts, together with ſix boys who aſſiſt them in the ſervice of the church, form a ſmall college in every town, wherein the hours and other exerciſes are regulated with the ſame formality and exactneſs as in the large colleges in the cities of Peru and Chili. The moſt troubleſome part of the duty of the aſſiſtant prieſts are the perſonal viſitations which they are obliged to make to the Indians to prevent their giving themſelves up to idleneſs; for ſuch is the ſlothfulneſs of the Guaranies, that if they were not very carefully looked after, the ſociety would receive no benefit or advantage from them. They alſo attend the public ſhambles, where the cattle neceſſary for the ſuſtenance of the Indians are daily ſlaughtered, and diſtribute the fleſh amongſt all the families in the town, in proportion to the number of perſons whereof each family conſiſts; ſo that all may have what is neceſſary,

(B) It produces maize, manioc, and potatoes, beſides many fruits and ſimples unknown in Europe. Vines, however, do not thrive, except in ſome particular places. Wheat has alſo been tried; but it is only uſed for cakes, and other things of that kind. There are great numbers of poiſonous ſerpents, and others of enormous ſize, many of which live on fiſh. It produces alſo abundance of ſugar, indigo, pimento, ipecacuanha, and variety of other drugs; and above all the herb Paraguay, which it exports to the value of 100,000l. annually, to the provinces of Chili and Peru. It is the leaf of a middle-ſized tree, reſembling an orange tree, in taſte not unlike mallows. There are three gatherings: firſt, the buds before it unfolds its leaves, which is the beſt, but ſooneſt ſubject to decay; the ſecond gathering is the full grown leaves at the firſt expanſion; the third is when the leaves have remained on ſome time after they are full blown. The leaves are roaſted, and then kept in pits dug in the ground to be ready for ſale. Theſe trees grow principally in the moraſſes on the eaſt ſide of Paraguay, but now are diſtributed all over the country. The manner of uſing it is, to dry and reduce it almoſt to powder, then put it into a cup with lemon juice and ſugar; boiling water is then poured on it, and the liquor drank as ſoon as may be. It is ſuppoſed to be ſerviceable in all diſorders of the head, breaſt, and ſtomach; it preſerves the miners from the noxious mineral ſteams with which they would otherwiſe be ſuffocated; is a ſovereign remedy in putrid fevers and the ſcurvy; allays hunger; and purifies all kind of water, by infuſing it therein. The country is diverſified with foreſts, mountains, low lands (great part of the year under water), fertile meadows, and moraſſes. Almoſt every foreſt abounds with bees, which have their hives in hollow trees. Beſides cotton, the country produces hemp, flax, corn, rice, and wool; and there are ſuch numbers of wild cattle, that they are killed only for their hides. The natives differ not materially from thoſe deſcribed under the article AMERICA.

Paraguay. ceffary, none what is fuperfluous. They alfo vifit the fick, and fee that they are properly taken care of. They are generally employed the whole day in thefe affairs, fo that they have feldom time to affift the curate in his fpiritual functions. All the boys and girls in the parifh go to church every day in the week (except on feftivals and Sundays), where they are inftructed by the curate. On Sundays the whole parifh goes to church to be inftructed. The curate is befides obliged to go to confefs the fick, and to adminifter the viaticum to thofe who defire it, and alfo to perform all the other functions peculiar to this office. In ftrictnefs the curate fhould be appointed in this manner. The fociety fhould nominate three perfons to the governor of Buenos Ayres (in whofe government the miffions of Paraguay are included), as being vice patron of the miffions, that he may choofe one of them for curate; and the curates fhould be inftructed in the duties of their office by the bifhop: but as the provincials of the order can beft judge who are properly qualified for the office, the governor and bifhop have ceded their rights to them, and by them the curates are always appointed. The miffions of the Guaranies and the miffions of the Chiquitos, into which the miffions of Paraguay are divided, have each their diftinct father-fuperior, by whom the coadjutors or affiftant curates of the feveral towns in the refpective divifions are appointed. Thefe fuperiors are continually vifiting the towns, to fee that they be well governed, and to endeavour to improve and augment them. They likewife from time to time take care to fend out fome fathers of the order into the countries of the wild Indians to make new converts. The better to enable him to difcharge thefe duties, the fuperior of the Guaranies is affifted by two vice-fuperiors; one of whom refides in Parana, the other upon the banks of the river Uruguay, and the fuperior himfelf refides in the town of Candelaria. The poft of fuperior of the Chiquitos is not near fo troublefome as that of the fuperior of the Guaranies; for the Chiquitos are not only lefs numerous, but much more docile and induftrious than the Guaranies, fo that they need not be continually watched and attended in order to prevent their idlenefs. The king allows an annual ftipend of 300 pezas to each curate of the Guaranies, for the maintenance of himfelf and his affiftants. The money is paid to the fuperior, who iffues out monthly to each curate as much as is neceffary for his fubfiftence; and when they want any thing extraordinary, their wants are fupplied upon application to him. But the Chiquitos maintain their own curates. In every town there is a plantation fet apart for the maintenance of the curate, which is cultivated by the joint labour of all the inhabitants. The produce of thefe plantations is generally more than fufficient for the fubfiftence of the curates, and the furplus is fold to buy ornaments for the churches. Nor are the curates the fpiritual rectors of the towns only; they are alfo in effect the civil governors. It is true there are in every town of the miffions a governor, regidores, and alcaldes, as there are in the other towns and cities under the Spanifh government. But though the governor is elected by the Indians, he muft be approved by the curate before he enters upon his office; nor can he chaftife or punifh delinquents without the curate's permiffion. The curate examines thofe who are accufed of offences; and if he finds them guilty, delivers them to the governor to be punifhed, according to the nature and quality of the offence commited. He fometimes orders them to be imprifoned for a few days, fometimes to faft, and, when the fault is confiderable, to be whipped, which is the fevereft punifhment that is ever inflicted; for the regulations and inftructions of the curates have been fo efficacious, that murder and fuch like heinous crimes are never here committed. And even before they undergo thefe gentle corrections, the curate difcourfes the offenders in a mild friendly manner; and endeavours to excite in them a due fenfe of their crime, and of the ill confequences that might flow from it, and to convince them that they merit a much greater punifhment than is inflicted. This mild treatment prevents tumults and infurrections, and acquires the curates univerfal veneration and efteem. The alcaldes are chofen annually by the regidores. The governor, regidores, and alcaldes are all Indians of the beft capacities; and are in effect only fo many overfeers appointed by the curate, and dignified with thefe empty titles (c).

Every town has its armory or magazine, in which are lodged the fire-arms or other weapons wherewith the militia are armed when they take the field to repel the irruptions of the Portuguefe and wild Indians. The militia are very dexterous and expert in the management of their arms; and are exercifed on the eves of feftivals in the fquares or public places of the towns. The militia is compofed of all thofe who are able to bear arms: they are formed into companies, which have each a proper number of officers chofen from amongft thofe who are moft diftinguifhed for judgment and conduct. The drefs of the officers is rich, adorned with gold and filver, and the device of the town to which they belong: they always appear in their uniforms on feftivals, and on the days of military exercife. The governor, alcaldes, and regidores have alfo proper robes and dreffes fuitable to their refpective offices, in which they appear on public occafions. There are fchools in every town, in which the common people are taught reading and writing, and alfo mufic and dancing; in which arts they become very fkilful. The Jefuits are very careful in confulting the natural bent and genius of their fcholars, and in directing their ftudies and application accordingly.



(c) We call them *empty titles*; becaufe in all caufes the Jefuit or curate of the parifh was a kind of fovereign regarded as a petty prince, and obeyed as an oracle. Whatever forms might take place in the choice of the chiefs of the feveral departments, their fuccefs ultimately depended on him. The cacique held of him; the general received his commiffion and inftructions from him; and all his decifions were without appeal. There were, we are informed, not lefs than 6000 parifhes on the banks of the rivers Uruguay and Parana, not exceeding the diftance of 30 miles from each other; in each of which was a Jefuit or curate.

Paraguay. The lads of the most promising genius are taught the Latin tongue with great success. In one of the court-yards of every curate's house are various shops or workhouses of painters, carvers, gilders, silversmiths, carpenters, weavers, and clockmakers, and of several other mechanics and artizans, who daily work for the public under the direction of the coadjutors, and at the same time teach the youth their respective arts and occupations.

The churches are large, well built, finely decorated and enlightened, and not inferior to the richest in Peru. Each church has a choir of music, composed of instruments of all sorts, and very good voices; so that divine service is celebrated here with as much pomp and solemnity as in cathedrals: nor are the public processions less splendid, especially that of the host; which, whenever it is carried abroad, is attended by the governor, alcaldes, and regidores, in their robes, and also by the militia in a body. The houses of the Indians are as well built and as well furnished as most of the Spanish houses in Peru. The greatest part indeed have mud walls, others are built with brick, and some with stone, but all are covered with tiles. In every town there is a house where gunpowder is made, that they may never want it when they are obliged to take arms, and always have it ready to make artificial fire works on rejoicing days: for all festivals are here observed with as great ceremony and exactness as in the greatest cities. Upon the proclamation of a new king of Spain, the governors, alcaldes, regidores, and officers of the militia, appear dressed in new robes and uniforms of a different fashion from those they wore before. There is a sort of a convent in every town; in one part whereof are confined women of an ill life, and the other part is destined for the reception of married women who have no family, and who retire thither when their husbands are absent. For the maintenance of this house, and for the support of orphans, and of old and infirm people, all the inhabitants of the town work two days in every week; and the profits of their labour, which is called *the labour of the community*, are set apart for this purpose. If the produce of this labour be more than is necessary for their subsistence, the surplus is laid out to buy ornaments for the churches, and clothes for the orphans and aged and infirm people; so that here are no beggars, nor any who want the necessaries of life. In short, by the wise policy and prudent regulations of the Jesuits, the whole community enjoys peace and happiness.

"The Guaranies are so profuse and negligent, that the curates are obliged to take into their hands all their goods and stuffs as soon as they are manufactured and made ready for sale; otherwise they would waste and destroy them, and not be able to maintain themselves. The Chiquitos, on the contrary, are diligent and frugal; so that the curates have no other trouble with them than the assisting them in the disposal of their goods, and procuring returns for them. For this purpose the society keeps a factor or procurator at Santa Fé and Buenos Ayres, to whom the merchandise of the missions is sent to be disposed of; and these factors return the value to the fathers in such sorts of European commodities as are wanted. The goods of every town are kept separate; and the royal taxes are taken out of them without any other discounts or allowances, save the stipends of the curates of the Guaranies and the pensions of the caciques. The fathers choose to manage the commerce of their subjects themselves, lest they should contract vices by their communication with other people. In this respect the fathers are so careful, that they will not suffer any of the people of Peru, whether they be Spaniards, Mestizos, or Indians, to enter into the territories of the missions. They say that the Indians are but just recovered from a barbarous and dissolute way of life, and that their manners are now pure and innocent; but that if strangers were suffered to come among them, the Indians would soon get acquainted with people of loose lives: and as the Guaranies especially are very prone to vice, wickedness, disorder, and rebellion would soon be introduced; the society would lose all the souls they have converted; and their little republic would be utterly subverted. However, there are some who suspect that these are all specious pretences; and that the society's real motive for prohibiting all intercourse with strangers, is the fear of rivals in the beneficial commerce of Paraguay, which is now entirely in their hands."

Such is the account they themselves have given us of their own conduct: but others have treated their characters with more severity; accusing them of pride, haughtiness, and abusing their authority to the greatest degree; insomuch that they would have caused the magistrates to be whipped in their presence, and obliged persons of the highest distinction within their jurisdiction to kiss the hem of their garment, as the greatest honour at which they could possibly arrive. To this might be added, the utter abolition of all ideas of property; which indeed was rendered useless by the general magazines and storehouses which they established, and from which, together with the herds of cattle kept for the public use, they supplied the wants of individuals as occasion required; yet still it was objected to the character of the fraternity, that they possessed large property themselves, and claimed the absolute disposal of the meanest effects in Paraguay. All manufactures belonged to them; every natural commodity was brought to them; and the treasures annually remitted to the superior of the order were thought to be a proof that zeal for religion was not the only motive by which they were influenced.

Besides the parochial or provincial governments, there was a kind of supreme council, composed of an annual meeting of all the fathers, who concerted the measures necessary for promoting the common concerns of the mission, framed new laws, corrected or abolished old ones, and, in a word, adapted every thing to circumstances. It is said to have been one of the great objects of the annual councils to take such measures as should effectually deprive strangers of all intelligence concerning the state of the mission. Hence the natives were restrained from learning the Spanish tongue, and were taught, that it was dangerous for their salvation to hold any conversation with a subject of Spain or Portugal. But the circumstance that rendered their designs most suspicious, was the establishment of a military force. Every parish had its corps of horse and foot, who were duly exercised every Sunday; and it was said, that the whole amounted to a body of 70,000 or 80,000 troops, well disciplined.

Such

Such was the ſtate of this country ſome time ago; but as to its ſituation ſince the abolition of the ſect of Jeſuits we can ſay nothing, as very little authentic intelligence is permitted to paſs from that country to this.

PARALIPOMENA, in matters of literature, denotes a ſupplement of things omitted in a preceding work.

PARALEPSIS. See ORATORY, N° 87.

PARALLACTIC, in general, ſomething relating to the parallax of heavenly bodies. See PARALLAX.

PARALLAX, in aſtronomy, is the difference between the places of any celeſtial object as ſeen from the ſurface, and from the centre of the earth at the ſame inſtant.

1 Illuſtration.

Let E in figure of parallax, Plate CCCLXXVI. repreſent the centre of the earth, O the place of an obſerver on its ſurface, whoſe viſible horizon is OH, and true horizon EF: Now let ZDT be a portion of a great circle in the heavens, and A the place of any object in the viſible horizon; join EA, and produce it to C; then C is the *true* place of the object, and H is its *apparent* place, and the angle CAH is the parallax; or, becauſe the object is in the horizon, it is called the *horizontal parallax*. But OAE, the angle which the earth's radius ſubtends at the object, is equal to CAH: Hence the horizontal parallax of an object may be defined to be the angle which the earth's ſemidiameter ſubtends at that object. For the various methods hitherto propoſed to find the quantity of the horizontal parallax of an object, ſee ASTRONOMY, N° 384—399 incluſive.

The whole effect of parallax is in a vertical direction: For the parallactic angle is in the plane paſſing through the obſerver and the earth's centre; which plane is neceſſarily perpendicular to the horizon, the earth being conſidered a ſphere.

2 The parallax decreaſes with the diſtance of the object from the zenith.

The more elevated an object is above the horizon, the leſs is the parallax, its diſtance from the earth's centre continuing the ſame. When the object is in the zenith, it has no parallax; but when in the horizon, its parallax is greateſt. The horizontal parallax being given, the parallax at any given altitude may be found by the following rule:

3 The ſine of the parallax in alt. is to the ſine of the hor. par. as the coſine of apparent altitude to the radius.

To the logarithmic coſine of the given altitude, and the log. ſine of the horizontal parallax, the ſum rejecting 10 from the index, will be the log. ſine of the parallax in altitude.

*Demonſtration.* Let B be the place of an object produce OB, ED to F and D; then the angle BOZ will be the apparent altitude of the object, BEZ the true altitude, and OBE the parallax in altitude. Now in the triangle AOE,

R : ſine OAE : : EA : EO.

And in the triangle OBE

BE (=EA) : EO : : ſine BOE : ſine OBE.

Hence R : coſine BOA : : ſine OAE : ſine OBE.

As the two laſt terms are generally ſmall quantities, the arch may be ſubſtituted in place of its ſine without any ſenſible error.

*Example.* Let the apparent altitude of the moon's centre be 39° 25′, and the moon's horizontal parallax 56′ 54″. Required the parallax in altitude.

| | | | |
|---|---|---|---|
| Moon's apparent alt. | 39° 25′ | coſine | 9.8879260 |
| Moon's horizontal par. | 56′ 54″ | ſine | 8.2188186 |
| Moon's par. in altitude | 43′ 57″ | ſine | 8.1067446 |

As the apparent place of an object is nearer the horizon than its true place, the parallax is therefore to be added to the apparent altitude, to obtain the true altitude. Hence alſo an object will appear to riſe later and ſet ſooner.

4 The ſine of the parallax of an object in the inverſe ratio of its diſtance from the earth's centre.

The ſine of the parallax of an object is inverſely as its diſtance from the earth's centre.

*Demonſtration.* Let A be the place of an object, and H the place of the ſame object at another time, or that of another object at the ſame inſtant; join EH, then in the triangles AOE, HOE.

R : ſine OAE : : AE : OE

ſine OHE : R : : OE : EH

Hence ſine OHE : ſine OAE : : AE : EH.

5 Parallax increaſes the apparent diſtance of an object from the meridian.

The parallax of an object makes it appear more diſtant from the meridian than it really is.

*Demonſtration.* The true and apparent places of an object are in the ſame vertical, the apparent place being lower than the true; and all verticals meet at the zenith: Hence the apparent place of an object is more diſtant from the plane of the meridian than the true place.

6 Parallax in longitude latitude, right aſcenſion, and declination.

The longitude, latitude, right aſcenſion, and declination of an object are affected by a parallax. The difference between the true and apparent longitudes is called the *parallax in longitude*; in like manner, the difference between the true and apparent latitudes, right aſcenſions, and declinations, are called the *parallax in latitude, right aſcenſion*, and *declination*, reſpectively.—When the object is in the nonageſimal, the parallax in longitude is nothing, but that in latitude is greateſt: and when the object is in the meridian, the parallax in right aſcenſion vaniſhes, and that in declination is a maximum. The apparent longitude is greater than the true longitude, when the object is eaſt of the nonageſimal, otherwiſe leſs; and when the object is in the eaſtern hemiſphere, the apparent right aſcenſion exceeds the true, but is leſs than the true right aſcenſion when the object is in the weſtern hemiſphere. The apparent place of an object is more diſtant from the elevated poles of the ecliptic and equator than the true place: hence, when the latitude of the place and elevated pole of the ecliptic are of the ſame name, the apparent latitude is leſs than the true latitude, otherwiſe greater; and the apparent declination will be leſs or greater than the true declination, according as the latitude of the place, and declination of the object, are of the ſame or of a contrary denomination.

The parallaxes in longitude, latitude, right aſcenſion, and declination, in the ſpheroidal hypotheſis, may be found by the following formulæ; in which $L$ repreſents the latitude of the place, diminiſhed by the angle contained between the vertical and radius of the given place; $P$ the horizontal parallax for that place; $a$ the altitude of the nonageſimal at the given inſtant; $d$ the apparent diſtance of the object from the nonageſimal; $l$ $\lambda$ the true and apparent latitudes of the object; $D$ $\delta$ the true and apparent declinations reſpectively; and $m$ its apparent diſtance from the meridian.

Then par. in long. = P. ſine $a$. ſine $d$. ſecant $l$, to radius unity; and par. in lat. = P. coſine $a$. coſine $\lambda$ $\mp$ $p$. coſine $d$. ſine $a$. ſine $\lambda$.

The ſign — is uſed when the apparent diſtance of the object from the nonageſimal and from the elevated pole of the ecliptic are of the ſame affection, and the ſign

ſign + if of different affection. If the greateſt preciſion be required, the following quantity 0.00000121216. par. long.$^2$, ſine 2 $l$, is to be applied to the parallax in latitude found as above, by addition or ſubtraction, according as the true diſtance of the object from the elevated pole of the ecliptic is greater or leſs than 90°.

Again, par. in right aſcen. = P. coſine L. ſine $m$. ſecant D, to radius unity: and par. in declination = P. ſine L. coſine $\delta \mp$ P. coſine L. ſine $\delta$, coſine $m$.

The upper or lower ſign is to be uſed, according as the diſtance of the object from the meridian and from the elevated pole of the equator are of the ſame or different affection. Part 2d. of par. in declination = 0.00000121216 par. in right aſcen.$^2$, ſine 2 D; which is additive to, or ſubtractive from, part firſt of parallax in declination, according as the true diſtance of the object from the elevated pole of the equator is greater or leſs than 90°. For the moon's parallax ſee Astronomy, N° 384 and 385. There is alſo a curious paper in the firſt volume of Aſiatic Reſearches, p. 320, &c. on the ſame ſubject, to which we refer our readers.

*Parallax of the Earth's annual Orbit*, is the difference between the places of a planet as ſeen from the ſun and earth at the ſame inſtant. The difference between the longitudes of the planet as ſeen from the ſun and earth is called the *parallax in longitude*; and the difference between its latitudes is the *parallax in latitude*.

Parallax, is alſo uſed to denote the change of place in an object ariſing from viewing it obliquely with reſpect to another object. Thus the minute hand of a watch is ſaid to have a parallax when it is viewed obliquely; and the difference between the inſtants ſhown by it, when viewed directly and obliquely, is the quantity of parallax in time.

PARALLEL, in geometry, an appellation given to lines, ſurfaces, and bodies, everywhere equidiſtant from each other. See Geometry.

*Parallel Sphere*, that ſituation of the ſphere wherein the equator coincides with the horizon, and the poles with the zenith and nadir.

*Parallel Sailing*. See Navigation, Book I. Chap. iv. p. 689.

*Parallels of Latitude*, in aſtronomy, are leſſer circles of the ſphere parallel to the ecliptic, imagined to paſs through every degree and minute of the colures.

*Parallels of Altitude*, or *Almucantars*, are circles parallel to the horizon, imagined to paſs through every degree and minute of the meridian between the horizon and zenith, having their poles in the zenith.

*Parallels of Declination*, in aſtronomy, are the ſame with parallels of latitude in geography.

PARALLELOPIPED, in geometry, a regular ſolid comprehended under ſix parallelograms, the oppoſite ones whereof are ſimilar, parallel, and equal to each other.

PARALLELOPIPEDIA, in natural hiſtory, a genus of ſpars, externally of a determinate and regular figure, always found looſe, detached, and ſeparate from all other bodies, and in form of an oblique parallelopiped, with ſix parallelogram ſides and eight ſolid angles; eaſily fiſſile either in a horizontal or perpendicular direction; being compoſed of numbers of thin plates, and thoſe very elegantly and regularly arranged bodies, each of the ſame form with the whole maſs, except that they are thinner in proportion to their horizontal planes, and naturally fall into theſe and no other figures, on being broken with a ſlight blow.

PARALOGISM, in logic, a falſe reaſoning, or a fault committed in demonſtration, when a conſequence is drawn from principles that are falſe; or, though true, are not proved; or when a propoſition is paſſed over that ſhould have been proved by the way.

PARALYSIS, the Palsy. See Medicine, N° 265.

PARAMECIA, in natural hiſtory, a name given to ſuch animalcules as have no viſible limbs or tails, and are of an irregularly oblong figure.

PARAMOUNT, (compounded of two French words, *par*, i. e. *per*, and *monter*, *aſcendere*), ſignifies in our law the "higheſt lord of the fee, of lands, tenements, and hereditaments." As there may be a lord meſne where lands are held of an inferior lord, who holds them of a ſuperior under certain ſervices; ſo this ſuperior lord is lord *paramount*. Alſo the king is the chief lord, or lord *paramount* of all the lands in the kingdom. *Co. Lit.* 1.

PARANYMPH, among the ancients, the perſon who waited on the bridegroom, and directed the nuptial ſolemnities; called alſo *pronubus* and *auſpex*, becauſe the ceremonies began by taking auſpicia. As the paranymph officiated only on the part of the bridegroom, a woman called *pronuba* officiated on the part of the bride.

PARAPET, in fortification, an elevation of earth deſigned for covering the ſoldiers from the enemy's cannon or ſmall ſhot. See Fortification.

PARAPHERNALIA, or Parapherna, in the civil law, thoſe goods which a wife brings her huſband beſides her dower, and which are ſtill to remain at her diſpoſal excluſive of her huſband, unleſs there is ſome proviſion made to the contrary in the marriage contract. Some of our Engliſh civilians define the paraphernalia to be ſuch goods as a wife challengeth over and above her dower or jointure, after her huſband's death; as furniture for her chamber, wearing apparel, and jewels, which are not to be put into the inventory of her huſband's goods; and a French civilian calls paraphernalia the moveables, linen, and other female neceſſaries, which are adjudged to a wife in prejudice of the creditors, when ſhe renounces the ſucceſſion of her huſband.

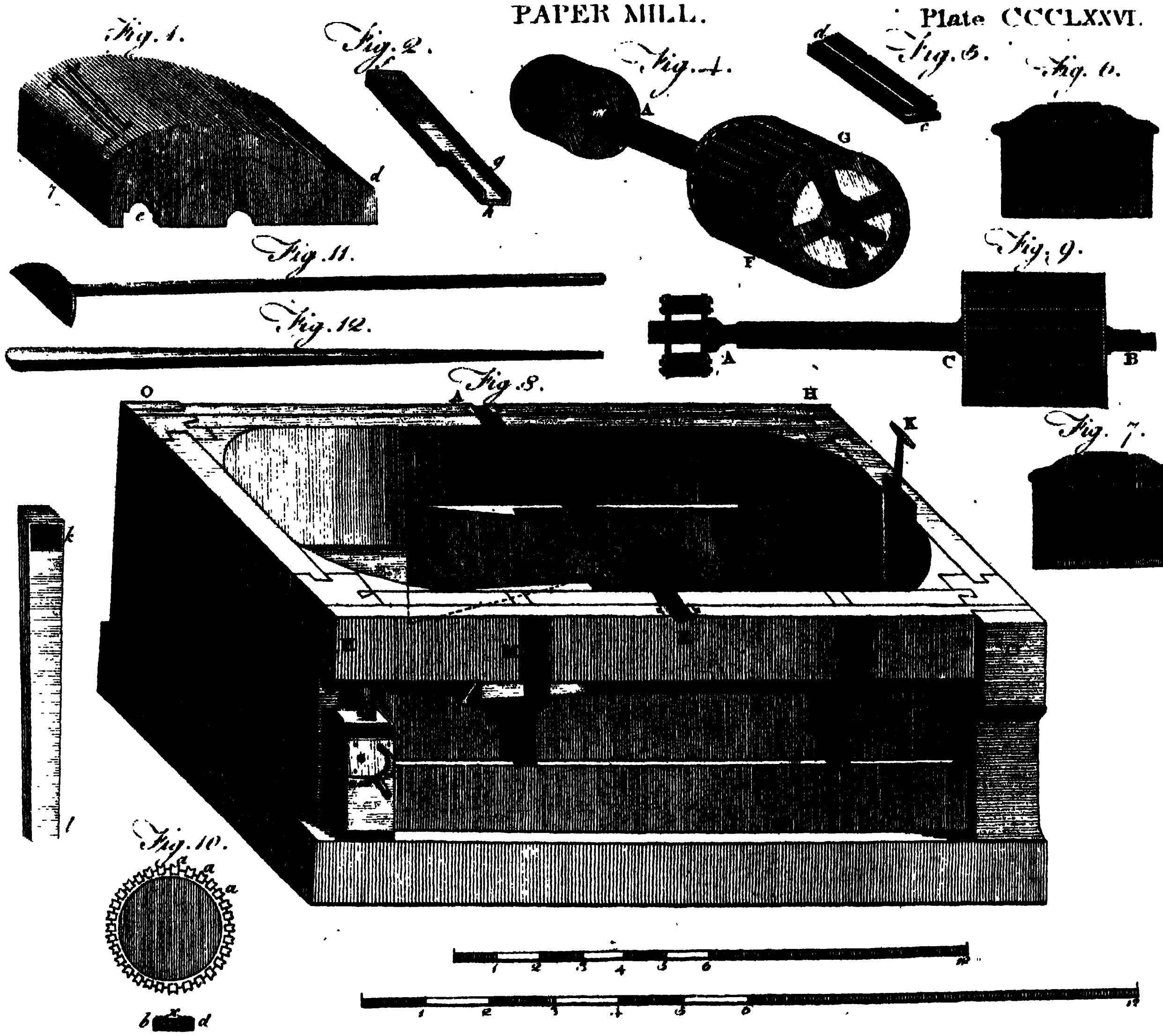
PARAPHIMOSIS, a diſorder of the penis, wherein the prepuce is ſhrunk, and withdrawn behind the glans, ſo as not to be capable of being brought to cover the ſame; which generally happens in venereal diſorders. See Surgery.

PARAPHRASE, an explanation of ſome text in clearer and more ample terms, whereby is ſupplied what the author might have ſaid or thought on the ſubject. Such are eſteemed Eraſmus's Paraphraſe on the New Teſtament, the Chaldee Paraphraſe on the Pentateuch, &c.

PARAPHRENITIS, an inflammation of the diaphragm. See Diaphragm, and *Index to Medicine*.

PARAPHROSYNE, a word uſed by medical writers to denote a delirium, or an alienation of mind in fevers, or from whatever other cauſe.

PAPER MILL. Plate CCCLXXVI.

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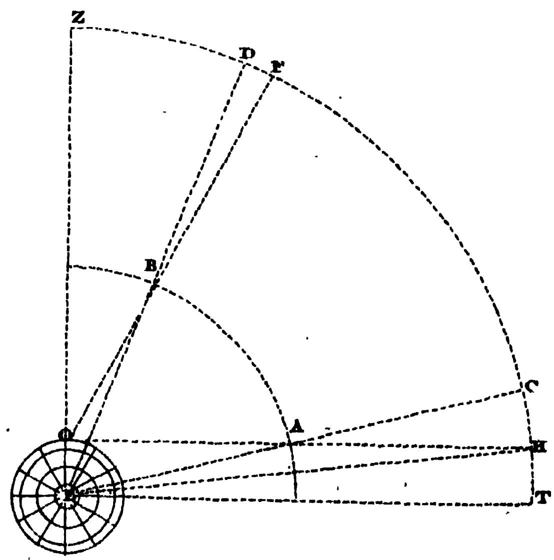



A. Bell Prin. Wall. Sculptor fecit.

PARAPLEGIA, a species of palsy. See MEDICINE, N° 268.

PARASANG, an ancient Persian measure, different at different times, and in different places; being usually 30, sometimes 40, and sometimes 50 stadia, or furlongs.—The word, according to Littleton, has its rise from *parasch angarius, q. d.* the space a postman rides from one station, *angaria*, to another.

PARASCENIUM, in the Grecian and Roman theatres, was a place behind the scenes whither the actors withdrew to dress and undress themselves. The Romans more frequently called it *Postscenium*. See THEATRE.

PARASELENE, in natural philosophy, a mock moon; a meteor or phenomenon encompassing or adjacent to the moon, in form of a luminous ring; wherein are observed sometimes one and sometimes two or more images of the moon.

PARASEMON, among the Greeks, was the figure carved on the prow of the ships to distinguish them from each other. This figure was generally that of a bull, lion, or other animal; sometimes the representation of a mountain, tree, flower, &c.

PARASITE, among the Greeks, was originally a very reputable title; the parasites being a kind of priests, at least ministers, of the gods, in the same manner as the epulones were at Rome. They took care of the sacred corn, or the corn destined for the service of the temples and the gods, viz. sacrifices, feasts, &c. They had even the intendance over sacrifices; and took care that they were duly performed. At Athens there was a kind of college of 12 parasites; each people of Attica furnishing one, who was always chosen out of the best families. Polybius adds, that a parasite was also an honourable title among the ancient Gauls, and was given to their poets. But of late it has been made a term of reproach, and used for a flatterer or mean dependent.

PARASITES, or PARASITICAL *Plants*, in botany, such plants as are produced out of the trunk or branches of other plants, from whence they receive their nourishment, and will not grow on the ground. Such are the misletoe, &c.

PARASTATÆ, in anatomy. See PROSTATE.

PARATALASSIA. See PRIMORIE.

PARBUNCLE, in a ship, the name of a rope almost like a pair of slings: it is seized both ends together, and then put almost double about any heavy thing that is to be hoisted in or out of the ship; having the hook of the runner hitched into it, to hoist it up by.

PARCÆ, in heathen mythology, goddesses who were supposed to preside over the accidents and events, and to determine the date or period, of human life.

The Parcæ were three, Clotho, Lachesis, and Atropos; because, forsooth, all things have their beginning, progress, and end. Hence the poets tell us, the Parcæ spun the thread of men's lives; that Clotho held the distaff, and drew the thread; Lachesis twirled the spindle, and spun it; and Atropos cut it. *Clotho colum retinet, Lachesis net, Atropos occat.*

The ancients represent the Parcæ divers ways: Lucian, in the shape of three poor old women, having large locks of wool, mixed with daffodils on their heads; one of which holds a distaff, the other a wheel, and the third a pair of sciffars, wherewith to cut the thread of life. Others represent them otherwise: Clotho appearing in a long robe of divers colours, wearing a crown upon her head adorned with seven stars, and holding a distaff in her hand: Lachesis in a robe beset with stars, with several spindles in her hand; and Atropos, clad in black, cutting the thread with a pair of large sciffars.



The ancients imagined that the Parcæ used white wool for a long and happy life, and black for a short and unfortunate one. See *Necessity* in MYTHOLOGY.

PARCHMENT, the skins of sheep or goats prepapared after such a manner as to render it proper for writing upon, covering books, &c.

The word comes from the Latin *pergamena*, the ancient name of this manufacture; which is said to have been taken from the city Pergamos, to Eumenes king whereof its invention is usually ascribed; though, in reality, that prince appears rather to have been the improver than the inventor of parchment. For the Persians of old, according to Diodorus, wrote all their records on skins; and the ancient Ionians, as we are told by Herodotus, made use of sheep skins and goat skins in writing, many ages before Eumenes's time. Nor need we doubt that such skins were prepared and dressed for that purpose, after a manner not unlike that of our parchment; though probably not so artificially.—The manufacture of parchment is begun by the skinner, and finished by the parchment maker.

The skin having been stripped of its wool, and placed in the lime pit, in the manner described under the article SHAMMY, the skinner stretches it on a kind of frame, and pares off the flesh with an iron instrument; this done, it is moistened with a rag; and powdered chalk being spread over it, the skinner takes a large pumice stone, flat at bottom, and rubs over the skin, and thus scours off the flesh; he then goes over it again with an iron instrument, moistens it as before, and rubs it again with the pumice stone without any chalk underneath: this smooths and softens the flesh side very considerably. He then drains it again, by passing over it the iron instrument as before. The flesh side being thus drained, by scraping off the moisture, he in the same manner passes the iron over the wool or hair side: then stretches it on a frame, and scrapes the flesh side again: this finishes its draining; and the more it is drained the whiter it becomes. The skinner now throws on more chalk, sweeping it over with a piece of lamb skin that has the wool on; and this smooths it still farther. It is now left to dry, and when dried, taken off the frame by cutting it all round. The skin thus far prepared by the skinner, is taken out of his hands by the parchment maker, who first, while it is dry, pares it on a summer, (which is a calf skin stretched in a frame), with a sharper instrument than that used by the skinner; and working with the arm from the top to the bottom of the skin, takes away about one half of its thickness. The skin thus equally pared on the flesh side, is again rendered smooth, by being rubbed with the pumice stone, on a bench covered with a sack stuffed with flocks; which leaves the parchment in a condition fit for writing upon. The parings thus taken off the leather, are used in making glue, size, &c. See the article GLUE, &c.

What is called *vellum* is only parchment made of the skins of abortives, or at least sucking calves. This

has

has a much finer grain, and is whiter and smoother than parchment; but is prepared in the same manner, except its not being passed through the lime pit.

PARDALIS, in natural history. See Felis.

PARDIES (Ignatius Gaston), an ingenious and learned French Jesuit, born at Paris in 1636. He taught polite literature for several years; during which time he composed several small pieces, both in prose and verse, with peculiar delicacy of thought and style. At length he devoted himself entirely to mathematics and natural philosophy, and read all authors, ancient as well as modern, in those branches of knowledge. He died in 1673, of an infectious disorder contracted by confessing and preaching to the prisoners in the Bicetre during the Easter holidays. Father Pardies published several works; of which his Elements of Geometry are well known in this country, where a translation of them has gone through several editions. In 1672 he had a dispute with Sir Isaac Newton respecting his Theory of Light and Colours; which may be seen in the Philosophical Transaction for that year.

PARDON, in criminal law, is the remitting or forgiving an offence committed against the king.

*Beccaria on Crimes and Punishments.*

Law (says an able writer), cannot be framed on principles of compassion to guilt; yet justice, by the constitution of England, is bound to be administered in mercy: this is promised by the king in his coronation oath; and it is that act of his government which is the most personal and most entirely his own. The king condemns no man; that rugged task he leaves to his courts of justice: the great operation of his sceptre is mercy. His power of pardoning was said by our Saxon ancestors to be derived *à lege suæ dignitatis*: and it is declared in parliament, by stat. 27 Hen. VIII. c. 24. that no other person hath power to pardon or remit any treason or felonies whatsoever; but that the king hath the whole and sole power thereof, united and knit to the imperial crown of this realm.

This is indeed one of the great advantages of monarchy in general above any other form of government, that there is a magistrate who has it in his power to extend mercy wherever he thinks it is deserved; holding a court of equity in his own breast, to soften the rigour of the general law, in such criminal cases as merit an exemption from punishment. Pardons (according to some theorists) should be excluded in a perfect legislation, where punishments are mild, but certain; for that the clemency of the prince seems a tacit disapprobation of the laws. But the exclusion of pardons must necessarily introduce a very dangerous power in the judge or jury; that of construing the criminal law by the spirit instead of the letter; or else it must be holden, what no man will seriously avow, that the situation and circumstances of the offender (though they alter not the essence of the crime) ought to make no distinction in the punishment. In democracies, however, this power of pardon can never subsist; for there nothing higher is acknowledged than the magistrate who administers the laws: and it would be impolitic for the power of judging and of pardoning to centre in one and the same person. This (as the President Montesquieu observes) would oblige him very often to contradict himself, to make and to unmake his decisions: it would tend to confound all ideas of right among the mass of people; as they would find it difficult to tell, whether a prisoner were discharged by his innocence, or obtained a pardon through favour." In Holland, therefore, if there be no stadtholder, there is no power of pardoning lodged in any other member of the state. But in monarchies the king acts in a superior sphere; and though he regulates the whole government as the first mover, yet he does not appear in any of the disagreeable or invidious parts of it. Whenever the nation see him personally engaged, it is only in works of legislature, munificence, or compassion. To him therefore the people look up as the fountain of nothing but bounty and grace; and these repeated acts of goodness, coming immediately from his own hand, endear the sovereign to his subjects, and contribute more than any thing to root in their hearts that filial affection and personal loyalty which are the sure establishment of a prince.

The king may pardon all offences merely against the crown or the public; excepting, 1. That, to preserve the liberty of the subject, the committing any man to prison out of the realm, is by the *habeas corpus* act, 31 Car. II. c. 2. made a *præmunire*, unpardonable even by the king. Nor, 2. can the king pardon, where private justice is principally concerned in the prosecution of offenders: *Non potest rex gratiam facere cum injuria et damno aliorum.* Therefore, in appeals of all kinds (which are the suit, not of the king, but of the party injured), the prosecutor may release; but the king cannot pardon. Neither can he pardon a common nuisance, while it remains unredressed, or so as to prevent an abatement of it; though afterwards he may remit the fine: because though the prosecution is vested in the king to avoid the multiplicity of suits, yet (during its continuance) this offence savours more of the nature of a *private* injury to each individual in the neighbourhood, than of a *public* wrong. Neither, lastly, can the king pardon an offence against a popular or penal statute, after information brought; for thereby the informer hath acquired a private property in his part of the penalty.

There is also a restriction of a peculiar nature, that affects the prerogative of pardoning, in case of parliamentary impeachments, viz. that the king's pardon cannot be pleaded to any such impeachment, so as to impede the inquiry, and stop the prosecution of great and notorious offenders. Therefore, when, in the reign of Charles II. the earl of Danby was impeached by the house of commons of high treason and other misdemeanors, and pleaded the king's pardon in bar of the same, the commons alleged, "That there was no precedent that ever any pardon was granted to any person impeached by the commons of high treason, or other high crimes, depending the impeachment;" and thereupon resolved, "That the pardon so pleaded was illegal and void, and ought not to be allowed in bar of the impeachment of the commons of England:" for which resolution they assigned this reason to the house of lords, "That the setting up a pardon to be a bar of an impeachment defeats the whole use and effect of impeachments: for should this point be admitted, or stand doubted, it would totally discourage the exhibiting any for the future; whereby the chief institution for the preservation of the government would be destroyed." Soon after the Revolution, the commons renewed the same claim, and voted,

Pardon.

voted, "That a pardon is not pleadable in bar of an impeachment." And at length, it was enacted by the act of settlement, 12 & 13 W. III. c. 2. "That no pardon under the great seal of England shall be pleadable to an impeachment by the commons in parliament." But, after the impeachment has been solemnly heard and determined, it is not understood that the king's royal grace is farther restrained or abridged: for, after the impeachment and attainder of the six rebel lords in 1715, three of them were from time to time reprieved by the crown; and at length received the benefit of the king's most gracious pardon.

The effect of such pardon by the king, is to make the offender a new man; to acquit him of all corporal penalties and forfeitures annexed to that offence for which he obtains his pardon; and not so much to restore his former, as to give him a new credit and capacity. But nothing can restore or purify the blood when once corrupted, if the pardon be not allowed till after attainder, but the high and transcendant power of parliament. Yet if a person attainted receives the king's pardon, and afterwards hath a son, that son may be heir to his father; because the father being made a new man, might transmit new inheritable blood; though, had he been born before the pardon, he could never have inherited at all.

Such is the nature of pardons in this kingdom. These, like other good things, may doubtless be abused; and if they are in any instance, their abuse deserves censure: but that in their nature they should be counted absurd, arbitrary, and destructive of morality, can, we suspect, proceed from nothing but from the presumptive petulance of modern reformers, or from the new system of civil equality.

*Godwin's Inquiry concerning Political Justice.*

We are told, however, by a late champion for the Rights of Man, that "the very word to a reflecting mind is fraught with absurdity. 'What is the rule that ought in all cases to prescribe to my conduct?' Surely justice: understanding by justice the greatest utility of the whole mass of things that may be influenced by my conduct. 'What then is clemency?' It can be nothing but the pitiable egotism of him who imagines he can do something better than justice. 'Is it right that I should suffer constraint for a certain offence?' The rectitude of my suffering must be founded in its tendency to promote the general welfare. He therefore that pardons me, iniquitously prefers the imaginary interest of an individual, and utterly neglects what he owes to the whole. He bestows that which I ought not to receive, and which he has no right to give. 'Is it right, on the contrary, that I should not undergo the suffering in question? Will he, by rescuing me from suffering, do a benefit to me, and no injury to others?' He will then be a notorious delinquent, if he allow me to suffer. There is indeed a considerable defect in this last supposition. If, while he benefits me, he do no injury to others, he is infallibly performing a public service. If I suffered in the arbitrary manner which the supposition includes, the whole would sustain an unquestionable injury in the injustice that was perpetrated. And yet the man who prevents this odious injustice, has been accustomed to arrogate to himself the attribute of clement, and the apparently sublime, but in reality tyrannical, name of forgiveness. For, if he do more than has been here described, instead of glory he ought to take shame to himself, as an enemy to the interest of human kind. If every action, and especially every action in which the happiness of a rational being is concerned, be susceptible of a certain rule, then caprice must be in all cases excluded: there can be no action, which if I neglect, I shall have discharged my duty; and, if I perform, I shall be entitled to applause."

Pardon.

Such is the reasoning of this zealous democrat; reasoning which, in our opinion, betrays want of feeling or ignorance of human nature. That human nature is such as, in the aggregate, to need controul, no one who is acquainted with it will deny; and there appears to be no other method of controuling mankind but by general laws; and these laws may, through the natural imperfection of human affairs, be cruel in one case, where they are just in another. Cases may likewise occur where the sentence of the law, without its execution, will answer every purpose which could be expected from it: and where the execution of it would be extreme cruelty, though it might in strict unfeeling language be called *justice*, because in conformity with the letter of the law: Yet though such cases may and do often occur, it would indeed be absurd to abolish any of those laws which the security of civil society has required; and therefore the only natural remedy against *legal injustice* is the *system of pardons*.

Our author next goes on to trace the origin of pardons; and instead of a definite system of law, we are told that it is necessary to have a court of reason, to which the decisions of a court of law shall be brought for revisal: a remedy apparently too vague and indeterminate to produce any lasting or good effect; and the proposal of which results from supposing mankind more virtuous and more knowing than they really are. We are next led to consider the abuses of pardons: from whence our author would draw an argument for their abolition; a species of reasoning unfair and unphilosophical. He tells us, that the authority in this case is placed first in the judge, and next in the king and council. "Now (says he), laying aside the propriety or impropriety of this particular selection, there is one grievous abuse which ought to strike the most superficial observer. These persons with whom the principal trust is reposed, consider their functions in this respect as a matter purely incidental, exercise them with supineness, and in many instances with the most scanty materials to guide their judgment. This grows in a considerable degree out of the very name of pardon, which implies a work of supererogatory benevolence."

Now it is obvious to remark, that pardons are in general granted in consequence of an application from people who have more *than scanty materials to guide their judgments*, and on whose fidelity in relating the circumstances of the case, confidence is placed or not according to their several characters. Our author next proceeds to the arbitrary character of pardons. "Such a system (he says), to speak it truly, is a lottery of death, in which each man draws his ticket for reprieve or execution, as undefinable accidents shall decide." The allusion here to a lottery ticket is peculiarly unfortunate and indelicate, nor does the whole sentence show any great degree of candour. It is possible to define

a particular crime, and to annex a particular punishment to the commission of it; but the nature of morality consists not in the external action, but in the motives which prompted to it. Definite law cannot, however, always make this distinction; and after the sentence of the law is pronounced, it comes to be considered whether there are any alleviating circumstances in the case; and whether there are or not, must depend on the particulars or accidents of the case: and it is indeed impossible to suppose that these accidents could be previously defined; their nature does not admit of it. To particularize and define every mode of an action which imagination can conceive, or which experience has shown us may happen, would indeed be an Herculean labour; and we might literally say with the Apostle, *that the world could not contain the books that might be written.* We are, however, told, that "reason is a thousand times more explicit and intelligible than law; and when we are accustomed to consult her, the certainty of her decisions would be such, as men practised in our present courts are totally unable to conceive." Were reason, however, appointed to be appealed to in all cases, and to be the final criterion, it would leave far greater room for villany than any mode at present in practice. *Reason* is a very uncertain and indefinite term, and may be made any thing, according to the circumstances or passions of men. Our reforming neighbours the French have raised a statue to *reason* and to *truth;* but what claim they have to either, Mr Godwin must himself decide.

We are next told that pardons are destructive to morality. "Another very important consequence (says our author) grows out of the system of pardons. A system of pardons is a system of unmitigated slavery. I am taught to expect a certain desirable event, from what? From the clemency, the uncontrouled, unmerited kindness of a fellow mortal. Can any lesson be more degrading? The pusillanimous servility of the man who devotes himself with everlasting obsequiousness to another, because that other having begun to be unjust, relents in his career; the ardour with which he confesses the rectitude of his sentence and the enormity of his deserts, will constitute a tale that future ages will find it difficult to understand. What are the sentiments in this respect that are alone worthy of a rational being? Give me that, and that only, which without injustice you cannot refuse. More than justice it would be disgraceful for me to ask, and for you to bestow. I stand upon the foundation of right. This is a title which brute force may refuse to acknowledge, but which all the force in the world cannot annihilate. By resisting this plea you may prove yourself unjust, but in yielding to it you grant me but my due. If, all things considered, I be the fit subject of a benefit, the benefit is merited: merit in any other sense is contradictory and absurd. If you bestow upon me unmerited advantage, you are a recreant from the general good. I may be base enough to thank you; but if I were virtuous, I should condemn you. These sentiments alone are consistent with true independence of mind. He that is accustomed to regard virtue as an affair of favour and grace, cannot be eminently virtuous. If he occasionally perform an action of apparent kindness, he will applaud the generosity of his sentiments; and if he abstain, he will acquit himself with the question, 'May I not do what I will with my own?' In the same manner, when he is treated benevolently by another, he will in the first place be unwilling to examine strictly into the reasonableness of this treatment, because benevolence, as he imagines, is not subject to any inflexibility of rule; and, in the second place, he will not regard his benefactor with that erect and unembarrassed mien, that complete sense of equality, which is the only immoveable basis of virtue and happiness."



Such is Mr Godwin's conclusion on this subject; and we leave it with our readers to determine, whether his system or that which we at present enjoy would be the more rigorous or unjust; or whether mankind are indeed arrived at that eminent pitch of virtue, as to disdain every favour which they do not absolutely merit. The Christian religion speaks a different language: but amidst the rage of popular reform, its *small still voice* is unheard and neglected.

PAREGORIES, in pharmacy, medicines that assuage pain, otherwise called ANODYNES.

PAREIRA FLAVA, in the materia medica, a kind of oblong and large root brought from the Brasils.—It is certainly a diuretic of no mean character, and has done great service in nephritic cases. In pleurisies and quinsies, it has been attended with more success than almost any medicine we know of singly.

PARELCON, in grammar, a figure by which a word or syllable is added to the end of another.

PAREMBOLE, in rhetoric, a figure wherein something relating to the subject is inserted in the middle of a period. All the difference between the parembole and parenthesis, according to Vossius, is, that the former relates to the subject in hand, whereas the latter is foreign to it.

PARENCHYMA, in anatomy, a term introduced by Erasistratus, signifying all that substance which is contained in the interstices betwixt the blood vessels of the viscera, which he imagined to be extravasated and concreted blood.

*PARENCHYMA of Plants.* Grew applies the term *parenchyma* to the pith or pulp, or that inner part of a fruit or plant through which the juice is supposed to be distributed. See PLANTS.

PARENT, a term of relation applicable to those from whom we immediately derive our being. See *MORAL Philosophy*, N° 129 and 137.

To this article belongs an inquiry into, 1. The legal duties of parents to their legitimate children. 2. Their power over them.

I. The duties of parents to legitimate children consist in three particulars; their *maintenance*, their *protection*, and their *education*.

1. The duty of parents to provide for the *maintenance* of their children, is a principle of natural law; an obligation, says Puffendorff, laid on them not only by nature herself, but by their own proper act, in bringing them into the world; for they would be in the highest manner injurious to their issue, if they only gave their children life, that they might afterwards see them perish. By begetting them, therefore, they have entered into a voluntary obligation, to endeavour, as far as in them lies, that the life which they have bestowed shall be supported and preserved. And thus *Blackst. Comment.*

Parent. the children will have a perfect right of receiving maintenance from their parents. And the President Montesquieu has a very just observation upon this head, that the establishment of marriage, in all civilized states, is built on this natural obligation of the father to provide for his children; for that ascertains and makes known the person who is bound to fulfil this obligation; whereas, in promiscuous and illicit conjunctions, the father is unknown; and the mother finds a thousand obstacles in her way; shame, remorse, the constraint of her sex, and the rigour of laws, that stifle her inclinations to perform this duty; and besides, she generally wants ability.

The municipal laws of all well regulated states have taken care to enforce this duty: though Providence has done it more effectually than any laws, by implanting in the breast of every parent that natural στοργη, or insuperable degree of affection, which not even the deformity of person or mind, not even the wickedness, ingratitude, and rebellion of children, can totally suppress or extinguish.

The civil law obliges the parent to provide maintenance for his child; and if he refuses, *judex de ea re cognoscet*. Nay, it carries this matter so far, that it will not suffer a parent at his death totally to disinherit his child, without expressly giving his reason for so doing; and there are 14 such reasons reckoned up, which may justify such disinherison. If the parent alleged no reason, or a bad, or a false one, the child might set the will aside, *tanquam testamentum inofficiosum*, a testament contrary to the natural duty of the parent. And it is remarkable under what colour the children were to move for relief in such a case; by suggesting, that the parent had lost the use of his reason when he made the *inofficious* testament. And this, as Puffendorff observes, was not to bring into dispute the testator's power of disinheriting his own offspring; but to examine the motives upon which he did it; and if they were found defective in reason, then to set them aside. But perhaps this is going rather too far: every man has, or ought to have, by the laws of society, a power over his own property: and, as Grotius very well distinguishes, natural right obliges to give a *necessary* maintenance to children; but what is more than that they have no right to, than as it is given by the favour of their parents, or the positive constitutions of the municipal law.

Let us next see what provision our own laws have made for this natural duty. It is a principle of law, that there is an obligation on every man to provide for those descended from his loins; and the manner in which this obligation shall be performed, is thus pointed out. The father and mother, grandfather and grandmother, of poor impotent persons, shall maintain them at their own charges, if of sufficient ability, according as the quarter sessions shall direct; and, if a parent runs away, and leaves his children, the church wardens and overseers of the parish shall seize his rents, goods, and chattels, and dispose of them towards their relief. By the interpretations which the courts of law have made upon these statutes, if a mother or grandmother marries again, and was before such second marriage of sufficient ability to keep the child, the husband shall be charged to maintain it; for this being a debt of her's, when single, shall, like others, extend to charge the husband. But, at her death, the relation being dissolved, the husband is under no farther obligation. Parent.

No person is bound to provide a maintenance for his issue, unless where the children are impotent and unable to work, either through infancy, disease, or accident; and then is only obliged to find them with necessaries, the penalty on refusal being no more than 20s. a month. For the policy of our laws, which are ever watchful to promote industry, did not mean to compel a father to maintain his idle and lazy children in ease and indolence; but thought it unjust to oblige the parent, against his will, to provide them with superfluities, and other indulgences of fortune; imagining they might trust to the impulse of nature, if the children were deserving of such favours. Yet, as nothing is so apt to stifle the calls of nature as religious bigotry, it is enacted, that if any Popish parent shall refuse to allow his Protestant child a fitting maintenance, with a view to compel him to change his religion, the lord chancellor shall by order of court constrain him to do what is just and reasonable. But this did not extend to persons of another religion, of no less bitterness and bigotry than the Popish: and therefore, in the very next year, we find an instance of a Jew of immense riches, whose only daughter having embraced Christianity, he turned her out of doors; and on her application for relief, it was held she was entitled to none. But this gave occasion to another statute, which ordains, that if Jewish parents refuse to allow their Protestant children a fitting maintenance, suitable to the fortune of the parent, the lord chancellor, on complaint, may make such order therein as he shall see proper.

Our law has made no provision to prevent the disinheriting of children by will; leaving every man's property in his own disposal, upon a principle of liberty in this as well as every other action; though perhaps it had not been amiss if the parent had been bound to leave them at the least a necessary subsistence. Indeed, among persons of any rank or fortune, a competence is generally provided for younger children, and the bulk of the estate settled upon the eldest by the marriage articles. Heirs also, and children, are favourites of our courts of justice, and cannot be disinherited by any dubious or ambiguous words; there being required the utmost certainty of the testator's intentions to take away the right of an heir.

2. From the duty of maintenance we may easily pass to that of *protection*; which is also a natural duty, but rather permitted than enjoined by any municipal laws; nature, in this respect, working so strongly as to need rather a check than a spur. A parent may, by our laws, maintain and uphold his children in their law-suits, without being guilty of the legal crime of maintaining quarrels. A parent may also justify an assault and battery in defence of the persons of his children; nay, where a man's son was beaten by another boy, and the father went near a mile to find him, and there revenged his son's quarrel by beating the other boy, of which beating he afterwards unfortunately died; it was not held to be murder, but manslaughter merely. Such indulgence does the law show to the frailty of human nature, and the workings of parental affection.

3. The last duty of parents to their children is that of

of giving them an *education* suitable to their station in life: a duty pointed out by reason and of far the greatest importance of any. For, as Puffendorff very well observes, it is not easy to imagine or allow, that a parent has conferred any considerable benefit upon his child by bringing him into the world, if he afterwards entirely neglects his culture and education, and suffers him to grow up like a mere beast, to lead a life useless to others, and shameful to himself. Yet the municipal laws of most countries seem to be defective in this point by not constraining the parent to bestow a proper education upon his children. Perhaps they thought it punishment enough to leave the parent who neglects the instruction of his family, to labour under those griefs and inconveniences which his family, so uninstructed, will be sure to bring upon him. Our laws though their defects in this particular cannot be denied, have in one instance made a wise provision for breeding up the rising generation; since the poor and laborious part of the community, when past the age of nurture, are taken out of the hands of their parents, by the statutes for apprenticing poor children; and are placed out by the public in such a manner as may render their abilities, in their several stations, of the greatest advantage to the commonwealth. The rich indeed are left at their own option, whether they will breed up their children to be ornaments or disgraces to their family. Yet in one case, that of religion, they are under peculiar restrictions: for it is provided that if any person sends any child under his government beyond the seas, either to prevent its good education in England, or in order to enter into, or reside in, any Popish college, or to be instructed, persuaded or strengthened in the Popish religion; in such case, besides the disabilities incurred by the child so sent, the parent or person sending shall forfeit 100l. which shall go to the sole use and benefit of him that shall discover the offence. And if any parent, or other, shall send or convey any person beyond sea, to enter into, or be resident in, or trained up in, any priory, abbey, nunnery, Popish university, college or school, or house of Jesuits or priests, or in any private Popish family in order to be instructed, persuaded or confirmed, in the Popish religion; or shall contribute any thing towards their maintenance when abroad by any pretext whatever, the person both sending and sent shall be disabled to sue in law or equity, or to be executor or administrator to any person, or to enjoy any legacy or deed of gift, or to bear any office in the realm, and shall forfeit all his goods and chattels, and likewise all his real estate for life. See NONCONFORMISTS.

II. The *power* of parents over their children is derived from the former consideration, their *duty*; this authority being given them, partly to enable the parent more effectually to perform his duty, and partly as a recompense for his care and trouble in the faithful discharge of it. And upon this score the municipal laws of some nations have given a much larger authority to the parents than others. The ancient Roman laws gave the father a power of life and death over his children; upon this principle, that he who gave had also the power of taking away. But the rigour of these laws was softened by subsequent constitutions: so that we find a father banished by the emperor Hadrian for killing his son, though he had committed a very heinous crime; upon this maxim, that *patris potestas in pietate debet, non in atrocitate, consistere.* But still they maintained to the last a very large and absolute authority: for a son could not acquire any property of his own during the life of his father; but all his acquisitions belonged to the father, or at least the profits of them for his life.

The power of a parent by the English law is much more moderate; but still sufficient to keep the child in order and obedience. He may lawfully correct his child, being under age, in a reasonable manner: for this is for the benefit of his education. The consent or concurrence of the parent to the marriage of his child under age, was also directed by our ancient law to be obtained: but now it is absolutely necessary; for without it the contract is void. And this also is another means which the law has put into the parent's hands, in order the better to discharge his duty; first, of protecting his children from the snares of artful and designing persons; and next of settling them properly in life, by preventing the ill consequences of too early and precipitate marriages. A father has no other power over his son's estate, than as his trustee or guardian: for though he may receive the profits during the child's minority, yet he must account for them when he comes of age. He may indeed have the benefit of his children's labour while they live with him and are maintained by him; but this is no more than he is entitled to from his apprentices or servants. The legal power of a father (for a mother, as such, is entitled to no power, but only to reverence and respect), the power of a father, we say, over the persons of his children ceases at the age of 21; for they are then enfranchised by arriving at years of discretion, or that point which the law has established (as some must necessarily be established) when the empire of the father, or other guardian, gives place to the empire of reason. Yet, till that age arrives, this empire of the father continues even after his death; for he may by his will appoint a guardian to his children. He may also delegate part of his parental authority, during his life, to the tutor or schoolmaster of his child; who is then *in loco parentis*, and has such a portion of the power of the parent committed to his charge, *viz.* that of restraint and correction, as may be necessary to answer the purposes for which he is employed.

In the Gentleman's Magazine for 1750, we have the following case of conscience. "A person has his own parents and his own children living, both parties equally indigent, both equally incapable of assisting themselves, and both equally earnest in calling upon him for relief. Things are so circumstanced that he can possibly assist but one party, and not both. *Query*, Which party has the greatest claim to his assistance, and to which is he obliged, by all ties human and divine, to give the preference?" One solves this difficulty, by informing us of a pretty print done at Rome, representing a young woman suckling her aged father, on which the following lines are quoted.

> My child and father vital nurture crave,
> Parental, filial, fondness both would save;
> But if a nursling only one can live,
> I choose to save the life I cannot give.

Here we find the preference given to the parent; and

Parent. and another correspondent gives the same decision in these words. "The obligations arising from nature, and natural affection, seem to be in this case reciprocal and equipollent: the child is as strongly attracted to the parent, as the parent to the child. But will not filial gratitude operate and decide in favour of the parents? Does not the person, either mediately or immediately owe his present power and abilities to relieve, to his parents? and are not they on that account best entitled to relief? Does not the fifth commandment declare more strongly in favour of the parents, than any other divine precept does in favour of the children? If a person had an opportunity given him of delivering either his parent or his child (but not both) from certain death, I dare say the voice of nature and of mankind would applaud him that saved his parent, and condemn him that should prefer his child. There is more of selfishness in preferring the child; and to save the parent seems to me to be much the more generous, noble, and exalted conduct. It is indeed, upon the whole, a melancholy alternative; but if both parties continue importunate, and neither will relinquish their claims in favour of the other, I say relieve the parent." There are two correspondents, however, who think differently, and their reasons are as follow: "A person's children have the greatest claim to his assistance, and he is obliged by all ties to prefer them, in that respect, to his parents. It is true, when a man's parents are in want, they have a claim to his assistance; but that claim is not equal to that which his children have. His parents he has of necessity: his children, of choice. It is his duty, before he beget children, to consider how he is to provide for them: and by being wilfully the cause of their existence, he comes under such an obligation to provide for their comfortable subsistence, as must be stronger than any obligation of that kind he can be under to persons with whom his connexion is involuntary. Both nature and reason point it out as the duty of all parents to provide for their children; but not *vice versa*. If a man's parents happen to be indigent, and he himself able, he is bound to maintain them out of respect and gratitude: but his obligation to provide for his children is a debt of strict justice; and therefore ought to be preferred. Nevertheless, the description of the case to which the query is subjoined, is so general, that it is easy to figure a case according to that description in which the person ought to prefer his parents. This obligation to provide for his children may have been dissolved by monstrous ingratitude, such as their plotting against his life; or he may have given them proper education, and ample provisions, which they have riotously squandered away: in either of which cases it is thought he is undoubtedly discharged from his obligation. But if they have lost their portions purely by misfortunes, without their fault, it is thought his obligation to assist them is not wholly extinguished; and in that case there may be great reason to doubt whether their claim to his assistance, or that of his parents, is preferable: it is thought, however, the children's is preferable." "I find (says the author of the last answer) that all your correspondents agree, that the life of the parent is to be preserved. It is very certain, that the relation between me and my child is exactly equal to that which is between me and my parent; and therefore relation cannot decide in favour of the one or the other: I must then be determined by a different consideration; and I know of none more weighty than the following. If I preserve the life of my child, I am instrumental in giving life to all his descendants, which may, perhaps, be very numerous; but if I preserve the life of my parent, I preserve a single life only, and that a short one. I therefore say, *relieve the child*. But it is thought that the voice of nature will applaud the person who preserves the parent: if so, nature must applaud a rule which she herself does not observe: it is natural for old men to die before young ones. Besides, the command, *Be fruitful and multiply, and replenish the earth*, may be opposed to the fifth commandment." Still, however, it is doubtless difficult to determine in such cases when they occur, as there are no fixed rules whereby to decide. With respect to the power of parents and the duty of children, much may be said. There is, however, scarcely any instance where either are oftener abused than with respect to marriage. This, as it is the most important event in the civil life either of a man or woman, so it is often rendered peculiarly unfortunate, by precipitate folly and want of duty in children; and as often through the unreasonable severity of parents. As a child is bound not to give unreasonable offence to a parent in the choice of a partner; so neither ought the parent to impose any improper or arbitrary restraint upon the child.

The power of a parent in China is very great; for a father, while living, has the power of an absolute despotic tyrant, and after his death is worshipped as a god. Let a son become ever so rich, and a father ever so poor, there is no submission, no point of obedience, that the latter cannot command, or that the former can refuse. The father is absolute master, not only of his son's estate, but also of his concubines and children, who, whenever, they displease him, he may sell to strangers. If a father accuses his son before a mandarin, there needs no proof of his guilt; for they cannot believe that any father can be so unnatural as to bring a false accusation against his own son. But should a son be so insolent as to mock his father, or arrive at such a pitch of wickedness as to strike him, all the province where this shameful act of violence is committed is alarmed; it even becomes the concern of the whole empire; the emperor himself judges the criminal. All the mandarins near the place are turned out of their posts, especially those of the town where he lived, for having been so negligent in their instructions; and all the neighbours are reprimanded for neglecting, by former punishments, to put a stop to the wickedness of the criminal before it arrived to such flagitiousness. As to the unhappy wretch himself, they cut him into a thousand pieces, burn his bones, level his house to the ground, and even those houses that stand near it, and set up monuments and memorials of the horrid deed.

*Payne's Geography.*

The emperor of China, who is one of the most powerful and despotic monarchs upon earth, pays the greatest attention to his mother. An instance of this Pere Amyot relates as having happened at Pekin, A. D. 1752, when the emperor's mother entered her 60th year, which, among the Chinese, is accounted a very remarkable period. Grosier likewise particularly describes the homage the emperor pays his mother

Parent.

mother every new-year's day in the palace, at which ceremony all the great officers of his court assist. See CHILDREN, *Filial Piety*, *Parental Affection*, &c.

PARENT (Unsoine), a mathematician, was born at Paris in 1666. He showed an early propensity to mathematics. He accustomed himself to write remarks upon the margins of the books which he read; and he had filled a variety of books with a kind of commentary at the early age of thirteen. At fourteen he was put under a master, who taught rhetoric at Chartres. It was here that he happened to see a dodecoëdron, upon every face of which was delineated a sun dial, except the lowest, whereon it stood. Struck as it were instantaneously with the curiosity of these dials, he attempted drawing one himself: but having a book which only showed the practical part without the theory, it was not till after his rhetoric master came to explain the doctrine of the sphere to him that he began to understand how the projection of the circles of the sphere formed sun dials. He then undertook to write a Treatise upon Gnomonics. The piece was indeed rude and unpolished; but it was entirely his own, and not borrowed. About the same time he wrote a book of Geometry, in the same taste, at Beauvois. His friends then sent for him to Paris to study the law; and, in obedience to them, he studied a course in that faculty: which was no sooner finished than, urged by his passion for mathematics, he shut himself up in the college of Dormans, that no avocation might take him from his beloved study: and, with an allowance of less than 200 livres a-year, he lived content in this retreat, from which he never stirred but to the Royal College, in order to hear the lectures of M. de la Hire or M. de Sauveur. When he found himself capable of teaching others, he took pupils: and fortification being a branch of mathematics which the war had brought into particular notice, he turned his attention to it; but after some time began to entertain scruples about teaching what he had never seen, and knew only by the force of imagination. He imparted this scruple to M. Sauveur, who recommended him to the Marquis d'Aligre, who luckily at that time wanted to have a mathematician with him. Parent made two campaigns with the marquis, by which he instructed himself sufficiently in viewing fortified places; of which he drew a number of plans, though he had never learned the art of drawing. From this period he spent his time in a continual application to the study of natural philosophy, and mathematics in all its branches, both speculative and practical; to which he joined anatomy, botany, and chemistry. His genius managed every thing, and yet he was incessant and indefatigable in his application. M. de Billettes, who was admitted in the Academy of Sciences at Paris in 1699, with the title of their mechanician, nominated for his disciple Parent, who excelled chiefly in this branch. It was soon discovered in this society, that he engaged in all the various subjects which were brought before them; and indeed that he had a hand in every thing. But this extent of knowledge, joined to a natural impetuosity of temper, raised in him a spirit of contradiction, which he indulged on all occasions; sometimes to a degree of precipitancy highly culpable, and often with but little regard to decency. Indeed the same behaviour was shown to him, and the papers which he brought to the academy were often treated with much severity. He was charged with obscurity in his productions; and he was indeed so notorious for this fault, that he perceived it himself, and could not avoid correcting it. The king had, by a regulation in 1716, suppressed the class of scholars of the academy, which seemed to put too great an inequality betwixt the members. Parent was made a joint or assistant member for geometry: but he enjoyed this promotion but a short time; for he was taken off by the smallpox the same year, at the age of 50. He was author of a great many pieces, chiefly on mechanics and geometry.

Parental.

PARENTAL, something belonging to the relation of parent. See PARENT.

*PARENTAL Affection*, the endearing attachment of parents to their children, including in it love; a desire of doing good to those who by an act of our own depend upon us for all that they enjoy. Nature even excites this affection in brutes: but in them it continues only so long as it is necessary for the preservation of their offspring; for when these are able to provide for themselves, it ceases, and the relation is forgotten. In man, however, though it lessens, or at least becomes less anxious as the dependence of the child becomes less, it never entirely ceases, except in some few instances of extreme depravity. Authors, however, have imagined, and Lord Kames'§ among the rest, that after the child is provided for, and no more depends on the parent, all affection would cease, were it not artificially preserved and confirmed by habit. Whether his lordship, in this opinion, be right or wrong, we shall not pretend to say. One thing, however, is certain, that be it natural or not, it is one of the greatest comforts of life, even when all dependence has ceased. It matters not that there are many instances where this comfort is not felt. Human depravity has often obliterated the finest feelings of the mind; and it is not to be wondered at if in some instances it do so in the case before us. A good heart certainly can enjoy no greater satisfaction than that arising from grateful returns of kindness and affection to an aged parent. As the vexations which parents receive from their children hasten the approach of age, and double the force of years; so the comforts which they reap from them are balm to all other sorrows, and disappoint the injuries of time. Parents repeat their lives in their offsprings; and their concern for them is so near, that they feel all their sufferings, and taste all their enjoyments, as much as if they regarded their own persons. However strong we may suppose the fondness of a father for his children, yet they will find more lively marks of tenderness in the bosom of a mother. There are no ties in nature to compare with those which unite an affectionate mother to her children, when they repay her tenderness with obedience and love.

§ *Sketches of the History of Man.*

We have a remarkable instance of parental affection in Zaleucus ‡ prince of the Locrines; who made a decree, that whoever was convicted of adultery should be punished with the loss of both his eyes. Soon after this establishment, the legislator's own son was apprehended in the very fact, and brought to a public trial. How could the father acquit himself in so tender and delicate a conjuncture? Should he execute the law in all its rigour, this would be worse than death

‡ *Ælian.* Lib. 13.

death to the unhappy youth: should he pardon so notorious a delinquent, this would defeat the design of his salutary institution. To avoid both these inconveniences, he ordered one of his own eyes to be pulled out and one of his son's.

Diodorus Siculus also, lib. 34. gives us a surprising instance of the same warm affection. Cambalus, a young gentleman of character and fortune in the city of Mulgeatum, being one day out a-coursing, was way-laid, and very near being robbed and murdered by the banditti who infested that part of the country. Gorgus, the young gentleman's father, happened to come by at the very instant, to whom Cambalus related the danger he was in. The son was on foot, the father on horseback; but no sooner had he heard the melancholy tale, than he leapt from his horse, desired his son to mount, and make the best of his way into the city: but Cambalus, preferring his father's safety to his own, would by no means consent to it; on the contrary, conjured his father to leave him, and take care of himself. The father, struck with the generosity and affection of his son, added tears to entreaties, but all to no purpose. The contest between them is better conceived than described—while bathed in tears, and beseeching each other to preserve his own life, the banditti approached and stabbed them both.

Amongst the ancient Greeks, the sentiments of parental affection were exceedingly strong and ardent. The mutual tenderness of the husband and the wife was communicated to their offspring; while the father viewed in his child the charms of its mother, and the mother perceived in it the manly graces of its father. As paternal kindness is the most simple and natural expansion of self-love, so there are innumerable instances of it in all countries savage and civilized.

PARENTALIA, in antiquity, funeral obsequies, or the last duties paid by children to their deceased parents.

PARENTHESIS, in grammar, certain intercalary words inserted in a discourse, which interrupt the sense or thread, but seem necessary for the better understanding of the subject.

PARENZO, a small but strong town of Italy, and in Istria, with a bishop's see and a good harbour; seated on the gulf of Venice, in E. Long. 13. 46. N. Lat. 39. 28. It submitted to the Venetians in 1267.

PARESIS, in medicine, a palsy of the bladder, wherein the urine is either suppressed or discharged involuntarily.

PARETONEUM, in natural history, the name of an earth found on the shores of Egypt, Cyrene, and the island of Crete, used by the ancients in painting.

It had its name either from a port of Egypt, near which it was gathered, or from the name of a town in that kingdom, where it was usually sold. Vitruvius is of the first opinion, and Volaternus of the other. Of late it was thought to be lost; but it is still common on the shores of most of the islands of the Archipelago, though not observed or regarded; and is truly a very heavy and tough clay of a fine white colour, found in masses of different sizes, generally as soft as the softer clays within the strata; and, by rolling about on the beach in this state, it gathers up the sand, small shells, and other foulnesses, we always find about it. It is likely that there are strata of it fine and pure in the cliffs there, and that the sea washes off masses of them in storms and high tides, which are what we find.

PARGET, in natural history, a name given to several kinds of gypsum, or plaster stone.

PARGETING, in building, is used for the plastering of walls, and sometimes for plaster itself.

Pargeting is of various kinds: as, 1. White lime and hair mortar laid on bare walls. 2. On bare laths, as in partitioning and plain ceiling. 3. Rendering the insides of walls, or doubling partition walls. 4. Rough-casting on heart laths. 5. Plastering on brick work, with finishing mortar, in imitation of stone work; and the like upon heart laths.

PARHELION, or PARHELIUM, formed from παρα *near*, and ἡλιος *sun*, in natural philosophy, a mock sun or meteor, in form of a very bright light, appearing on the one side of the sun.

Appearances of this kind have been made mention of both by the ancients and moderns. Aristotle observes, that in general they are seen only when the sun is near the horizon, though he takes notice of two that were seen in Bosphorus from morning to evening; and Pliny has related the times when such phenomena were observed at Rome. Gassendi says, that in 1635 and 1636 he often saw one mock sun. Two were observed by M. de la Hire in 1689; and the same number by Cassini in 1693, Mr Grey in 1700, and Dr Halley in 1702: but the most celebrated appearances of this kind were seen at Rome by Scheiner, by Muschenbroek at Utrecht, and by Hevelius at Sedan. By the two former, four mock suns were observed, and by the latter seven.

Parhelia are apparently of the same size with the sun, though not always of the same brightness, nor even of the same shape; and when a number appear at once, there is some difference in both these respects among them. Externally they are tinged with colours like the rainbow; and many have a long fiery tail opposite to the sun, but paler towards the extremity. Parhelia are generally accompanied with coronas, some of which are tinged with rainbow colours, but others are white. They differ in number and size; but all agree in breadth, which is that of the apparent diameter of the sun.

A very large white circle, parallel to the horizon, generally passes through all the parhelia; and, if it were entire, it would go through the centre of the sun. Sometimes there are arcs of lesser circles concentric to this, touching those coloured circles which surround the sun. They are also tinged with colours, and contain other parhelia. There are also said to have been other circles obliquely situated with respect to all those we have mentioned; but of this we have met with no authentic account. The order of the colours in these circles is the same as in the rainbow; but on the inside, with respect to the sun, they are red, as is also observed in many other coronas.

Parhelia have been visible for 1, 2, 3, and 4 hours together; and in North America they are said to continue some days, and to be visible from sunrise to sunset.

When the parhelia disappear, it sometimes rains, or there

 there falls snow in the form of oblong spiculæ, as Maraldi, Weidler, Krafft, and others, have observed; and because the air in North America abounds with such frozen spiculæ, which are even visible to the eye, according to Ellis and Middleton, such particles have been thought to be the cause of all coronas and parhelia.

Mr Ellis says, that, at Churchill in Hudson's Bay, the rising of the sun is always preceded by two long streams of red light, one on each side of him, and about 20° distant from him. These rise as the sun rises; and as they grow longer begin to bend towards each other, till they meet directly over the sun, just as he rises, forming there a kind of parhelion or mock sun. These two streams of light, he says, seem to have their source in two other parhelia, which rise with the true sun; and in the winter season, when the sun never rises above the haze or fog, which he says is constantly found near the horizon, all these accompany him the whole day, and set with him in the same manner as they rise. Once or twice he saw a fourth parhelion directly under the true sun; but this, he says, is not common. These facts being constant, are very valuable, and may throw great light on the theory of these remarkable phenomena.

Sometimes parhelia appear in a different manner; as when three suns have been seen in the same vertical circle, well defined, and touching one another. The true sun was in the middle, and the lowest touched the horizon; and they set one after the other. This appearance was seen by M. Maleziew in 1722. Other appearances similar to this are recited by M. Muschenbroeck.

Sometimes the sun has risen or set with a luminous tail projecting from him, of the same breadth with his diameter, and perpendicular to the horizon. Such an appearance was seen by Cassini in 1672 and 1692, by De la Hire in 1702, and by Mr Ellis in Hudson's Bay.

As M. Feuilée was walking on the banks of the river La Plata, he saw the sun rising over the river with a luminous tail projecting downwards, which continued till he was six degrees high.

Parasolenæ, or mock moons, have also been seen, accompanied with tails and coloured circles, like those which accompany the parhelia. An account of several, and a particular description of a fine appearance of this kind, may be seen in Muschenbroek.

The Roman phenomenon, observed by Scheiner, is famous on account of its having been the first appearance of the kind that engaged the attention of philosophers. It is represented in fig. 1.; in which A is the place of the observer, B his zenith, C the true sun, AB a plane passing through the observer's eye, the true sun, and the zenith. About the sun C, there appeared two concentric rings, not complete, but diversified with colours. The lesser of them, DEF, was fuller, and more perfect; and though it was open from D to F, yet those ends were perpetually endeavouring to unite; and sometimes they did so. The outer of these rings was much fainter, so as scarcely to be discernible. It had, however, a variety of colours; but was very inconstant. The third circle, KLMN, was very large, and all over white, passing through the middle of the sun, and everywhere parallel to the horizon. At first this circle was entire; but towards the end of the appearance it was weak and ragged, so as hardly to be perceived from M towards N.

Plate CCCLXXVII

In the intersection of this circle, and the outward iris GKI, there broke out two parhelia or mock suns, N and K, not quite perfect; K being rather weak, but N shone brighter and stronger. The brightness of the middle of them was something like that of the sun; but towards the edges they were tinged with colours like those of the rainbow; and they were uneven and ragged. The parhelion N was a little wavering, and sent out a spiked tail, NP, of a colour somewhat fiery, the length of which was continually changing.

The parhelia at L and M in the horizontal ring were not so bright as the former; but were rounder, and white, like the circle in which they were placed. The parhelion N disappeared before K; and while M grew fainter, K grew brighter, and vanished the last of all.

It is to be observed farther, that the order of the colours in the circles DEF, GKN, was the same as in the common halos, namely, red next the sun; and the diameter of the inner circle was also about 45 degrees; which is the usual size of a halo.

The reverend Dr Hamilton sent the following account of parhelia seen at Cookstown to the Royal Irish Academy.

"Wednesday September 24. 1783, as I was preparing to observe the sun passing the meridian, before the first limb touched the centre wire, it was obscured by a dark well defined cloud, about 10° in diameter. Upon going to the door of the transit room, to see if it was likely soon to pass off the disk of the sun, I observed the following phenomena: From the western edge of the cloud issued a luminous arc parallel to the horizon, perfectly well defined, extending exactly to the northern meridian; it was about 30′ broad, white, and ended in a blunted termination. On it were two parhelia; the nearest to the sun displaying the prismatic colours; the remote one white, and both ill defined. In a short time the cloud had passed off, and showed the luminous almucantar, reaching perfect to the true sun. While things were thus situated, I measured with an accurate sextant the distances of the parhelia; I found the coloured one 26°, the remoter one 90°, from the true sun. Just as I had done this, a new and prismatic circle surrounded the sun immediately with the prismatic parhelion. And now another coloured parhelion appeared on the eastern board.—The sextant with its face up and down, exactly measured this and the former at the original distance of 26°; the luminous almucantar still remaining perfect. In about 10 or 12 minutes whitish hazy clouds came on, and obscured all these uncommon appearances.—I did not observe that the atmospherical phenomena before or after were at all uncommon. The wind a light breeze at SSW. Bar. 29,6 rising. Thermometer 55°.

In fig. 2. SM represents the south meridian; NM the north meridian; PP the prismatic circle, with two prismatic suns or parhelia, at 26° distance on each side the true sun; W the white parhelion, at 90° distance from the true sun; LA the luminous almucantar; and HO the horizon.

Various

Various hypotheses have been framed by philosophers to account for this phenomenon, particularly by M. Marriotte, Descartes, and Huygens. None of them, however, are satisfactory: but those readers who wish to become acquainted with them may consult Huygens's Dissertation on this subject, in Smith's Optics, Book I. ch. 11. Muschenbroeck's Introduction, &c. Vol. XI. p. 1038, &c. 4to.; but especially Dr Priestley's History of Vision, Light, and Colours, Vol. II. p. 613, &c.

PARIA, or NEW ANDALUSIA, a country of Terra Firma in South America; bounded on the north by the north sea; on the east by Surinam; on the west by New Granada and the Caraccas: and on the south by Guiana. It produces colouring drugs, gums, medicinal roots, Brazil wood, sugar, tobacco, and some valuable timber; the inland parts being woody and mountainous, but interspersed with fine valleys that yield corn and pasturage. Comana is the capital town.

PARIAN CHRONICLE. See *ARUNDELIAN Marbles*, and *Parian CHRONICLE*.

Under the article *Parian CHRONICLE*, we have been as full as the subject seemed to require, or as the nature of our work would admit. It is unnecessary, therefore, to resume it in this place. Such of our readers, however, as wish for further information on this subject (which is equally interesting to the scholar and to the antiquarian) we must refer to Robertson's attack upon their authenticity, and to Gough's learned and judicious vindication of the authenticity, published in *Archæologia* for 1789. The extent of his learning, and the solidity of his arguments, appear upon the whole to outweigh the objections of his sensible and plausible opponent. Hewlett's book upon the same side of the question may command some degree of attention. It is ingenious. See *SANDWICH Marble*.

*PARIAN Marble*, in the natural history of the ancients, the white marble used then, and to this day, for carving statues, &c. and called by us at this time *statuary marble*.

Too many of the later writers have confounded all the white marbles under the name of the *Parian;* and among the workmen, this and all the other white marbles have the common name of *alabasters;* so that it is in general forgotten among them, that there is such a thing as alabaster different from marble; which, however, is truly the case. Almost all the world also have confounded the Carrara marble with this, though they are really very different; the Carrara kind being of a finer structure and clearer white than the Parian; but less bright and splendid, harder to cut, and not capable of so glittering a polish.

The true Parian marble has usually somewhat of a faint bluish tinge among the white, and often has blue veins in different parts of it. It is supposed by some to have had its name from the island Paros †, one of the Cyclades in the Ægean sea, where it was first found; but others will have it to have been so called from Agoracritus Parius, a famous statuary, who ennobled it by cutting a statue of Venus in it.

† See Paros.

PARIAS, or PERREAS, a tribe of Hindoos, so peculiarly distinguished from all others, that they live by themselves in the outskirts of towns; and, in the country, build their houses apart from the villages, or rather have villages of their own, furnished with wells; for they dare not so much as fetch water from those which other families make use of; and, lest these latter should inadvertently go to one of theirs, they are obliged to scatter the bones of dead cattle about their wells, that they may be known. They dare not in cities pass through the streets where the Bramins live; nor set foot in the villages where they dwell.—They are likewise forbidden to enter a temple, either of their god Wistnow or Eswara; because they are held impure. They get their bread by sowing, digging, and building the walls of mud houses; most of those inhabited by the common people being raised by these Parias; who also do such kinds of dirty work as other people do not care to meddle with. Nor is their diet much more cleanly; for they do not scruple to eat cows, horses, fowl, or other carrion, which die of themselves, and even stink. One would scarce imagine, that contentions for precedency should ever enter into the thoughts of a people who have renounced all cleanliness, and, like swine, wallow in filth; and yet pride has divided the Parias into two classes: the first are simply called *Parias*, the other *Seriperes*. The employment of these latter is to go about selling leather, which they dress; also to make bridles, and such kind of things: some of them likewise serve for soldiers. The Parias, who reckon themselves the better family, will not eat in the house of the Seriperes; but the Seriperes will readily eat with the Parias. For this reason they are obliged to pay them respect, by lifting their hands aloft, and standing upright before them. These Seriperes, when they marry, cannot set up a pandal, a kind of garland, before their doors, made with more than three stakes or trees; should they exceed that number, the whole city would be in motion. The Seriperes are likewise subject to some sort of slavery; for when any person of credit or authority dies in the families of the Komitis, Sittis, Palis, farriers, or goldsmiths, and the friends have a mind to be at the expence of some clothes to give the Seriperes, these latter must suffer their beards to be shaven; and when the corpse is carried out of town to be burned or interred, they must do that office; for which each receives a *fanum*, or one piece and a half of silver, worth three sous and a half. These are the same sort of people who are called at Surat *Halalchors;* that is, in the Persian language, "eat-alls, or eaters at large." Nothing can offend an Hindoo more than to be called a Halalchor: yet these poor people are not offended, cringe and bow to all they pass, and go through their drudgery without noise or concern.

Mod. Univ. Hist. v. 5.

The Parias are very vicious, stupid, and ignorant, occasioned by their wretched way of life: The Bramins and nobility shun them as if they had the plague, and look on the meeting a Parias as the greatest misfortune. To come near one of them is a sin, to touch them a sacrilege. If a Parias were dying, it is infamy to visit him, or to give him the least assistance, in the utmost danger or distress. A Bramin who unavoidably should touch a Parias, immediately washes himself from the impurity. Even their shadow and breath being reckoned contagious, they are obliged to live on the east side of their towns, that the westerly winds which reign in this country may keep back their breath. And it is lawful for a Bramin to kill one of

of these unhappy creatures, if he does not avoid it by getting out of his way: In short, they think them reprobated by God, and believe the souls of the damned enter into the Parias, to be punished for their crimes.—Yet the mission have found among these dregs of the people very active zealous catechists, who by their labours have very much contributed to the conversion of their countrymen, particularly one Rajanaiken a Paria soldier, who, of all the inferior missionaries, has distinguished himself most by his labours and sufferings.

PARIETALIA ossa, in anatomy. See there N° 13.

PARIETARIA, *Pellitory of the Wall*: A genus of the monœcia order, belonging to the polygamia class of plants; and in the natural method ranking under the 53d order, *Scabridæ*. The calyx of the hermaphrodite is quadrifid; there is no corolla; there are four stamina; one style; and one seed, superior and elongated. The female calyx is quadrifid; there is no corolla; nor are there any stamina. There is one style; and one seed superior, and elongated. There are six species, of which one named the *officinalis* is used in medicine. This has a creeping root. The stalk grows erect, is rough to the touch, and adhesive. The leaves are alternate, elliptical, lanceolate, veined, and a little rough. The flowers grow out of the alæ of the leaves, in sessile, branched, verticillate clusters, of a greenish colour tinged with red. The antheræ have a great degree of sensibility; for, if irritated with the point of a pin, they fly from the calyx with elastic force, and throw out their powder. The plant has a cooling and diuretic quality. Three ounces of the juice taken internally, or a fomentation externally applied, have been found serviceable in the strangury. The plant laid upon heaps of corn infested with weevils, is said to drive away those destructive insects.

PARIETES, in anatomy, a term used for the enclosures or membranes that stop up or close the hollow parts of the body; especially those of the heart, the thorax, &c. The parietes of the two ventricles of the heart are of unequal strength and thickness; the left exceeding the right, because of its office, which is to force the blood through all parts of the body; whereas the right only drives it through the lungs.

PARIS (Matthew), one of our best historians from William the Conqueror to the latter end of the reign of Henry III. but of his life few particulars have been transmitted to us. Leland his original biographer, without determining whether he was born in France or England, informs us, that he was a monk of St Alban's, and that he was sent by Pope Innocent to reform the monks of the convent at Holm in Norway. Bishop Bale, the next in point of time, adds to the above relation, that, on account of his extraordinary gifts of body and mind, he was much esteemed, particularly by King Henry III. who commanded him to write the history of his reign. Fuller makes him a native of Cambridgeshire, because there was an ancient family of his name in that county. He also mentions his being sent by the pope to visit the monks in the diocese of Norwich. Bishop Tanner, Bishop Nicholson, Doctor Du Pin, and the *Nouveau Dictionnaire Historique*, add not a single fact to those above related. Matthew Paris died in the monastery of St. Alban's in the year 1259. He was doubtless a man of extraordinary knowledge for the 13th century; of an excellent moral character, and, as an historian, of strict integrity. His style is unpolished; but that defect is sufficiently atoned for by the honest freedom with which he relates the truth, regardless of the dignity or sanctity of the persons concerned. His works are, 1. *Historia ab Adamo ad Conquestum Angliæ*, Lib. I. manuscript, col. C. C. Cantab. c. ix. Most of this book is transcribed, by Matthew of Westminster, into the first part of his *Florilegium*. 2. *Historia major, seu rerum Anglicanarum historia à Gul. Conquestoris adventu ad annum 43 Henrici* III. &c. several times printed. The first part of this history, viz. to the year 1235, is transcribed almost verbatim from the Chronicle of Roger Wendover; and the Appendix, from the year 1260, is the work of William Rashinger, who was also a monk of St. Alban's. 3. *Vitæ duorum Offarum, Merciæ regum, S. Albani fundatorum*. 4. *Gesta 22 abbatum S. Albani*. 5. *Additamenta chronicorum ad hist. majorem*; printed. 6. *Historia minor, sive epitome majoris historiæ*; manuscript. Besides many other things in manuscript.

Paris, son of Priam, king of Troy, by Hecuba, also named *Alexander*. He was decreed, even before his birth, to become the ruin of his country; and when his mother, in the first months of her pregnancy, had dreamed that she should bring forth a torch which would set fire to her palace, the soothsayers foretold the calamities which were to be expected from the imprudence of her future son, and which would end in the ruin of Troy. Priam, to prevent so great and so alarming an evil, ordered his slave Archelaus to destroy the child as soon as he was born. The slave, either touched with humanity, or influenced by Hecuba, did not obey, but was satisfied to expose the child on Mount Ida, where the shepherds of the place found him, and educated him as their own. Some attribute the preservation of his life, before he was found by the shepherds, to the motherly tenderness of a she bear who suckled him. Young Paris, though educated among shepherds and peasants, gave very early proofs of courage and intrepidity; and from his care in protecting the flocks of Mount Ida from the rapacity of the wild beasts, he was named *Alexander*, "helper or defender." He gained the esteem of all the shepherds, and his graceful countenance and manly deportment recommended him to the favours of Œnone, a nymph of Ida, whom he married, and with whom he lived with the most perfect tenderness. Their conjugal peace was, however, of no long duration. At the marriage of Peleus and Thetis, the goddess of discord, who had not been invited to partake of the entertainment, showed her displeasure, by throwing into the assembly of the gods who were at the celebration of the nuptials, a golden apple, on which were written the words *Detur pulchriori*. All the goddesses claimed it as their own; the contention at first became general; but at last only three, Juno, Venus, and Minerva, wished to dispute their respective right to beauty. The gods, unwilling to become arbiters in an affair so tender and so delicate in its nature, appointed Paris to adjudge the prize of beauty to the fairest of the goddesses; and indeed the shepherd seemed sufficiently qualified

Paris. qualified to decide so great a contest, as his wisdom was so well established, and his prudence and sagacity so well known. The goddesses appeared before their judge without any covering or ornament, and each endeavoured by promises and entreaties to gain the attention of Paris, and to influence his judgment. Juno promised him a kingdom; Minerva military glory; and Venus the fairest woman in the world for his wife, as Ovid expresses it, *Heroid* 17. v. 118.

*Unaque cum regnum; belli daret altera laudem;*
*Tyndaridis conjux, tertia dixit, eris.*

After he had heard their several claims and promises, Paris adjudged the prize to Venus, and gave her the golden apple, to which perhaps she seemed entitled as the goddess of beauty. This decision of Paris drew upon the judge and his family the resentment of the two other goddesses. Soon after, Priam proposed a contest among his sons and other princes, and promised to reward the conqueror with one of the finest bulls of Mount Ida. His emissaries were sent to procure the animal, and it was found in the possession of Paris, who reluctantly yielded it. The shepherd was anxious to regain his favourite, and he went to Troy and entered the lists of the combatants. He was received with the greatest applause, and obtained the victory over his rivals, Nestor the son of Neleus, Cycnus son of Neptune, Polites, Helenus, and Deiphobus, sons of Priam. He likewise obtained a superiority over Hector himself; which prince, enraged to see himself conquered by an unknown stranger, pursued him closely; and Paris must have fallen a victim to his brother's rage, had he not fled to the altar of Jupiter. This sacred retreat preserved his life; and Cassandra the daughter of Priam, struck with the similarity of the features of Paris with those of her brothers, inquired his birth and his age. From these circumstances she soon discovered that he was her brother, and as such she introduced him to her father and to her brothers. Priam acknowledged Paris as his son, forgetful of the alarming dreams which had caused him to meditate his death, and all jealousy ceased among the brothers. Paris did not long suffer himself to remain inactive; he equipped a fleet, as if willing to redeem Hesione his father's sister, whom Hercules had carried away and obliged to marry Telamon the son of Æacus. This was the pretended motive of his voyage, but the causes were far different. Paris remembered that he was to be the husband of the fairest of women; and, if he had been led to form those expectations while he was an obscure shepherd of Ida, he had now every plausible reason to see them realized, since he was the acknowledged son of the king of Troy. Helen was the fairest woman of the age, and Venus had promised her to him. On these grounds, therefore, he went to Sparta, the residence of Helen, who had married Menelaus. He was received with great respect; but he abused the hospitality of Menelaus, and while the husband was absent in Crete, Paris persuaded Helen to elope with him, and to fly to Asia. Helen consented; and Priam received her into his palace without difficulty, as his sister was then detained in a foreign country, and as he wished to show himself as hostile as possible to the Greeks. This affair was soon productive of serious consequences. When Menelaus had married Helen, all her suitors had bound themselves by a solemn oath to protect her person, and to defend her from every violence; and therefore the injured husband reminded them of their engagements, and called upon them to recover her. Upon this all Greece took up arms in the cause of Menelaus; Agamemnon was chosen general of all the combined forces, and a regular war was begun. Paris, meanwhile, who had refused Helen to the petitions and embassies of the Greeks, armed himself, with his brothers and subjects, to oppose the enemy; but the success of the war was neither hindered nor accelerated by his means. He fought with little courage, and at the very sight of Menelaus, whom he had so recently injured, all his resolution vanished, and he retired from the front of the army, where he walked before like a conqueror. In a combat with Menelaus, which he undertook by means of his brother Hector, Paris must have perished, had not Venus interfered, and stolen him from the resentment of his antagonist. He wounded, however, in another battle, Machaon, Euryphilus, and Diomedes; and, according to some opinions, he killed with one of his arrows the great Achilles.

The death of Paris is differently related: some say that he was mortally wounded by one of the arrows of Philoctetes, which had been once in the possession of Hercules; and that when he found himself languid on account of his wounds, he ordered himself to be carried to the feet of Œnone, whom he had basely abandoned, and who in the years of his obscurity had foretold him that he would solicit her assistance in his dying moments. He expired before he came into the presence of Œnone; and the nymph, still mindful of their former loves, threw herself upon his body, and stabbed herself to the heart, after she had plentifully bathed it with her tears. According to others, Paris did not immediately go to Troy when he left the Peloponnesus, but he was driven on the coasts of Egypt, where Proteus, who was king of the country, detained him; and when he heard of the violence which had been offered to the king of Sparta, he kept Helen at his court, and permitted Paris to retire. Whatever was the mode of his death, it took place, we are told about 1188 B. C. See Troy, &c.

Paris, the capital of the kingdom of France; is situated on the river Seine, in the Isle of France, being one of the largest and finest cities in Europe. It derived its modern name from the ancient Parisii; and is supposed by some to have had the Latin name of *Lutetia*, from *Lutum*, "mud," the place where it now stands having been anciently very marshy and muddy. Ever since the reign of Hugh Capet, that is, for near 800 years, this city hath been the usual residence of the kings of France; it is of a circular form, and, including the suburbs, about five French leagues, or 15 English miles, in circumference. The number of its inhabitants is computed at about 500,000 (A); that of its



(A) The latest, and perhaps the most accurate, accounts, have stated the number of inhabitants in Paris at considerably upwards of 800,000. It is supposed to be less than London, but the difference is not thought to be very great.

ſtreets 912; and that of its houſes upwards of 20,000, excluſive of the public ſtructures of all ſorts. Its greateſt defect, according to ſome, is the want of good drinking water; but others tell us, that very fine water is brought by an aqueduct from the village of Arcueil, not far from Paris, but own that the water of the Seine, and the city, is not good. The ſtreets are of a proper breadth, well built, paved, and lighted. There is a great number of tribunals and offices here; moſt of which are kept in the Palais, ſituated on an iſland, to which it gives name. The number of churches, convents, hoſpitals, market places, fountains, gates, and bridges, in this city is very great; beſides the univerſity, ſeveral academies, public libraries, royal palaces and caſtles, and above 100 hotels, ſome of them very ſtately. But to be more particular, that part called *la Cité*, lies in the centre, and conſiſts of three iſlands formed by the Seine, *viz.* L'Iſle de Palais, L'Iſle de Notre Dame, and L'Iſle Louviers. It is the principal of the three parts into which the city is divided, and contains the following remarkable ſtructures: 1. Several bridges; of which ſome are of wood and others of ſtone, and have moſt of them a row of houſes on each ſide. The chief of theſe are the Pont-neuf and Pont-royal: the firſt conſiſts of 12 arches, which, properly ſpeaking, make two bridges, the one leading from the ſuburb of St Germain to the city, and the other from thence to that part called *la Ville:* there is a carriage way in the middle 30 feet broad, and foot-walks on each ſide, raiſed two feet high; and in the centre ſtands a braſs ſtatue of King Henry IV. on horſeback. On this bridge is alſo the building called *La Samaritaine*, from a group of figures upon it repreſenting our Saviour and the Samaritan woman, ſtanding near Jacob's well. Here is a pump to raiſe the water, which through ſeveral pipes ſupplies the quarter of the Louvre, and ſome other parts of the town. The Pont-royal, which leads to the Thuilleries, was built by order of Lewis XIV. in the room of a wooden bridge that was carried away by the current in 1684. 2. The cathedral of Notre Dame, or our Lady, being dedicated to the Holy Virgin, which is a large ſtately Gothic ſtructure, ſaid to have been founded by King Childeric, and built in the form of a croſs. Here, beſides other great perſonages, are interred the cardinals de Retz and Noailles. From the two ſquare towers belonging to it, is a noble proſpect of the city and neighbouring country. Here is a vaſt quantity of gold and ſilver plate, rich tapeſtry, and fine paintings; and the number of the canons is no leſs than 50. Near it ſtands the palace of the archbiſhop, in which is the advocates library: the revenue of the archbiſhop amounts to about 180,000 livres; and his taxation to the court of Rome is 4283 guilders. 3. The priory and pariſh church of St Bartholomew; the laſt of which is the moſt beautiful in all this part of the city, and ſtands near the Palais. 4. The Palais, which gives name to an iſland, and in which the parliament, with a great many other courts, are held. It was anciently the reſidence of the kings; but was given to the officers of juſtice by Philip the Fair, who alſo ſettled the parliament here in 1302. The parliament, conſiſting of ſeveral chambers, each of which has its department, is opened the day after Martinmas with a ſolemn maſs, celebrated by a biſhop, and continues ſitting till the 8th of September, when a vacation chamber is appointed during the interval, for criminal cauſes, and others which require deſpatch. The juriſdiction of this court is of great extent. There is a beautiful chapel belonging to the Palais: in which is alſo the priſon, or jail, for the juriſdiction of the parliament, called in French *La Conciergerie.* 5. The Hotel Dieu, the moſt ancient and largeſt hoſpital in Paris, in which 8000 ſick and infirm poor are taken care of, and attended by the nuns of the order of St Auguſtine. 6. The hoſpital of St Catharine, where poor women and maidens are entertained three days, and attended by the above-mentioned nuns. 6. The Grande Chatelet, where ſome of the inferior courts of juſtice hold their ſeſſions. 8. Fort l'Eveque, in which is the mint and a priſon. It ſtands in or near the ſtreet La Ferroniere, in which Henry IV. was ſtabbed by Ravilliac. 9. St Germain l'Auxerrois, which is called the *royal palace church;* becauſe the palaces of the Louvre and Thuilleries ſtand in its pariſh. 10. The Louvre, an ancient royal palace, of which a part was rebuilt by Lewis XIV. Had it been completed on the ſame plan, it would have been a moſt magnificent ſtructure. On one of its gates is the following inſcription, *Dum totum impleat orbem:* the meaning of which is, "May it laſt till the owner of it hath extended his ſway over the whole world:" which implies what the French kings have conſtantly aimed at. Another inſcription ſhows, at the ſame time, the vanity of the nation, and their abject flattery of their grand monarque. It may be rendered in Engliſh thus:

Louvre is a palace for great Lewis fit:
God him alone exceeds, as heaven does it.

This palace is joined to the Thuilleries by a gallery, in which are 180 models of fortreſſes, ſome ſituated in France, and ſome in other countries, executed with the utmoſt accuracy. Here is a valuable collection of paintings, the king's printing houſe, the mint where the king's medals are ſtruck, together with a prodigious quantity of rich tapeſtry hangings, and a collection of ancient arms, among which are thoſe worn by Francis I. at the famous battle of Pavia. Here alſo the French academy, the academy of inſcriptions and belles letters, the royal academy of ſciences, the academy of painting and ſculpture, and the royal acacemy of architecture, have their meetings. The firſt of theſe was founded for the improvement of the French language; and as for the others, their names explain the deſign of their inſtitution. 11. Le Palais Royal, which was built by Cardinal Richelieu, in the year 1636, and belongs to the duke of Orleans. It is ſaid to contain pictures to the value of four millions of livres, which were purchaſed by the regent of that title, and of which a part belonged to Chriſtina queen of Sweden. 12. The palace des Thuilleries, ſo called from a tile or brick kiln which ſtood there formerly. This palace, as we obſerved above, communicates with the Louvre by a gallery. Behind it are exceeding pleaſant gardens, adorned with fine walks, planted with evergreens, and other trees, and with beautiful parterres, where are to be ſeen, all the year round, every flower according to its ſeaſon. There are alſo three fine fountains in the garden, and a canal. Behind the Thuilleries, on the bank of the river, are pleaſant walks,

Paris. composed of four rows of lofty elms, to which vast crowds of people resort in the fine weather, as well as to the gardens. In the palace is a spacious and magnificent theatre; and hard by it are the Elysian fields, where a surprising number of coaches are to be seen in fair weather: not far off is the church of St Roche, where the celebrated poet Corneille is interred. 13. La place de Louis le Grand, a very beautiful square, in the centre of which is an equestrian statue of that king, which is justly accounted a masterpiece. 14. The Place, or Square des Victoires, which is round, and contains a statue of Lewis XIV. of gilt brass, erected to him by the duke de la Fuillade, with this inscription, *Viro immortali.* 15. The Royal Library in the Rue Vivien, which contains 94,000 printed books, 30,000 manuscripts, and a prodigious collection of copperplates and medals. Near by, in the churchyard of St Joseph, lies the famous comic poet Moliere. 16. The parish church of St Eustace, which stands in the quarter of the same name, and contains the tomb of the great minister Colbert. 17. The gate of St Dennis, which was erected as a triumphal arch in honour of Lewis XIV. 18. The gate of St Martin, erected also in form of a triumphal arch, in honour of the same king. Not far from hence, in the churchyard of St Nicholas des Champs, Peter Gassendi, and other learned men, are buried. 19. La Greve, an open place, where all public rejoicings are celebrated, and malefactors executed. 20. The Hotel de Ville, which is a large building of Gothic architecture, though adorned with columns of the Corinthian order. 21. The arsenal in the quarter of St Paul, consisting of many spacious buildings, among which are a foundery, and a house for making saltpetre. Here is a musquetoon of two barrels, which it is said will pierce a thick board at the distance of six miles; and for discerning an object at that distance, has a telescope fixed to the barrel. 22. The Bastile, a kind of fortress like the Tower of London, which is used as a prison for state criminals, and for such as are taken up by letters de cachet, *i. e.* by warrants signed by the king, and sealed. 23. Le Temple, a commandery of the knights of Malta, which gives name to a quarter, wherein, being a privileged place, artificers that are not freemen may carry on their business without molestation. The temple is the residence of the grand prior of the French nation. 24. That formerly called *La Maison professe des Jesuites*, in the quarter of St Anthony, in the church of which the hearts of Lewis XIII. and XIV. are preserved, each in a casket of gold, supported by two angels of massy silver, and as big as the life, hovering with expanded wings. In the same quarter is a fine looking glass manufacture, where above 500 persons are employed in polishing plates cast at St Gobin; with a convent of Franciscans, the monks of which are called *Pique puces*, or *Prick fleas*.

In that part of the city called the *University*, the principal places are,

1. The university, which gives name to it and which was first founded, as it is said, by Charles the Great: all the arts and sciences are taught here, particularly law, physic, and divinity. There are above 40 colleges; of which the chief are those of Sorbonne, of Navarre, of the faculty of physic, and of the four nations; but lectures are read only in eleven of them. The head of the university is the rector, who is chosen every three months, but sometimes is continued several years. All the professors have settled salaries; the whole annual income of the university amounting, it is said, to about 50,000 livres. 2. The Gobelins, a house or palace, where a great number of ingenious artists, in various manufactures and handicrafts, are employed by the government. The most curious tapestry of all sorts is made here. 3. The General Hospital, a most noble foundation for the poor of the female sex, near 7000 objects being taken care of and provided for. The sick are carefully tended; and those that are in health are obliged to work; different wards being alloted for foundlings, for girls who sew or knit, prostitutes, idiots, and poor women: of the last, some are kept gratis, and others pay a small matter. In the castle of Bicêtre, belonging to this hospital, and consisting of many large buildings, are near 4000 persons of the other sex, among which are persons disordered in their senses, and such as are afflicted with the venereal disease. To this hospital are also sent children who abuse their parents, and lead dissolute lives. The fund for the maintenance of it, and the hospital de la Pitié, where poor children are brought up, together with the Hotel Dieu, amounts to above two millions of livres *per annum*. 4. The King's Physic Garden, in which are an infinite variety of plants and trees, a certain sum being allotted by the king for keeping the garden in order, and improving it, and for lectures on botany, anatomy, chemistry, and the materia medica. A curious collection of natural curiosities is kept here. 5. The abbey of St Victor, in which is a public library, containing some very ancient and scarce books, several curious manuscripts, and a prodigious collection of maps and copperplates. 6. The College of Physicians, to which belong five professors. 7. The Little Chatelet, an old fortress, now used for a prison. 8. The Rue St Jacques, chiefly inhabited by booksellers. 9. The Royal College, and that of Lewis the Great: to the former belong twelve professors. 10. The Abbey of St Genevieve, in which is the marble monument of King Clovis, the shrine of St Genevieve, a large library, with a cabinet of antiquities and natural curiosities. 11. The Royal Observatory, a most stately edifice, built on the highest part of the city. Several astronomers are maintained here by the king. 12. The Royal Academy of Surgery, instituted in 1721. 13. The Convent of Franciscans, in the quarter of St Andrew, the richest in France. In the same quarter are some remains of the palace of Julian the Apostate, in which Childebert, and some other kings of the Franks, afterwards resided. 14. The Playhouse. 15. The Convent of Carthusians, in the quarter of Luxemburgh, containing fine paintings. 16. The palace of Luxemburgh, or Orleans, a magnificent structure, containing also some fine paintings by Rubens, and embellished with a noble garden. In the Hotel des Ambassadeurs, ambassadors extraordinary are entertained for three days, and those of remote countries all the time they stay at Paris. 17. The Abbey of St Germain des Prez, which contains a very valuable library, the manuscripts alone making 8000 volumes: here also is a cabinet of antiquities. 18. The Hotel Royal des Invalides erected by Louis XIV. in which

lame

lame and superannuated officers and soldiers are maintained. The buildings take up no less than 17 acres. The number of common soldiers here amount to about 3000, and of officers to about 500. The chapel is very magnificent. Hard by is a military academy, in which 500 young gentlemen are instructed in the art of war.

Our readers from the above account will be able to conceive what Paris was; what it is we cannot so easily show them. Possessed by a set of men who disgrace human nature, and whose reign may be as short as that of a considerable number of those who have preceded them, its state in every sense is fluctuating and undetermined; insomuch that what may be true of it to-day, would perhaps be false to-morrow. Respecting its public buildings, internal police, and other circumstances, it is impossible to speak with certainty. The Bastile is levelled with the dust; but unjust imprisonments have not ceased; and other places in that extensive capital overflow with unfortunate persons who deserved a better fate; whose only crime is, that they are related to the late lamented king; that they were once nobles or allied to nobility; or that they are churchmen, or wish for some regular government to relieve their distracted country from the anarchy that has destroyed it. The church of Notre Dame one of the finest cathedrals in Europe, is no more a place of Christian worship, but has been solemnly dedicated by the deluded people to *reason* and *philosophy*. Its archbishop has renounced the peaceful religion of Jesus (a thing almost unheard of in the history of Christianity); and has with his own hand knocked down those images which ancient superstition indeed had erected, but which should nevertheless have been removed with reverence and decency. On the whole, such strange and unlooked-for revolutions have taken place in this once flourishing city, as renders it impossible to say where they may end, or what may be their consequences.—To give a history of the events that have occurred here within these few years, is not our business in an article of this sort. They have been partly, *i. e.* as far as they were then known, mentioned under the article FRANCE; and for further information, our readers were there referred to REVOLUTION. To this article we again refer them, in hopes that something decisive may (by the time that we arrive at that period of our work) have taken place with respect to the kingdom of which Paris is the capital.

PARIS, *Herb Paris*, or *Truelove*: A genus of the trigynia order, belonging to the octandria class of plants; and in the natural method ranking under the 11th order, *Sarmentaceæ*. The calyx is tetraphyllous; there are four petals, narrow in proportion; the berry quadrilocular. There is but one species, growing naturally in woods and shady places both in Scotland and England. It hath a single naked stem, greenish blossoms, and bluish black berries.—The leaves and berries are said to partake of the properties of opium; and the juice of the berries is useful in inflammations of the eyes. Linnæus says, that the root will vomit as well as ipecacuanha, but must be taken in double the quantity. Goats and sheep eat the plant; cows, horses, and swine, refuse it. Though this plant has been reckoned of a poisonous nature, being ranked among the aconites; yet late authors attribute quite other properties to it, esteeming it to be a counter poison, and good in malignant and pestilential fevers.



*Herb PARIS of Canada or of America, Trillium*, in botany, a genus of the hexandria trigynia class: The characters are, that it has a three-leaved spreading empalement, and three oval petals; it has six awl-shaped stamina, terminated by oblong summits, and a roundish germen with three slender recurved styles, crowned by single stigmas; the germen afterwards becomes a roundish berry, with three cells filled with roundish seeds. There are three species.

*Plaster of PARIS*. See PLASTER *of Paris*.

PARISH, the precinct of a parochial church, or a circuit of ground inhabited by people who belong to one church, and are under the particular charge of its minister.

The word comes from the Latin *parochia*, the Greek παροικια *habitation*; compounded of παρα *near*, and οικος *house*.—Accordingly Du Cange observes, that the name παροικια was anciently given to the whole territory of a bishop, and derives it from *neighbourhood*; because the primitive Christians, not daring to assemble openly in cities, were forced to meet secretly in neighbouring houses.

In the ancient church there was one large edifice in each city for the people to meet in; and this they called *parochia*, "Parish." But the signification of the word was afterwards enlarged, and by a parish was meant a diocese, or the extent of the jurisdiction of a bishop, consisting of several churches, unless we will suppose, as some do, that those bishops were only pastors of single churches. Du Pin observes, that country parishes had not their origin before the 4th century; but those of cities are more ancient. The city of Alexandria is said to have been the first that was divided into parishes.

How ancient the division of parishes is, is not indeed absolutely certain; for in the early ages of Christianity in this island, parishes were unknown, or at least signified the same that a diocese now does. There was then no appropriation of ecclesiastical dues to any particular church; but every man was at liberty to contribute his tithes to any priest or church he pleased, but he was obliged to do it to some; or if he made no special appropriation thereof, they were paid to the bishop, whose duty it was to distribute them among the clergy, and for other pious purposes, according to his own discretion. Camden says England was divided into parishes by Archbishop Honorius about the year 630. Sir Henry Hobart maintains that parishes were first erected by the council of Lateran, held A. D. 1179. But Mr Selden proves, that the clergy lived in common without any division of parishes, long after the time mentioned by Camden; and it appears from the Saxon laws, that parishes were in being long before the council of Lateran in 1179. The distinction of parishes occurs in the laws of King Edgar, about the year 970. It seems pretty clear and certain, says Judge Blackstone (Com. Vol. I. p. 112.), that the boundaries of parishes were first ascertained by those of a manor or manors; because it very seldom happens that a manor extends itself over more than one parish, though there are often many manors in one parish. The lords, he adds, as Christianity spread, began to build churches upon their own demesnes or wastes, in order to accommodate

commodate their tenants in one or two adjoining lordships; nd that they might have divine service regularly performed therein, obliged all their tenants to appropriate their tithes to the maintenance of the one officiating minister, instead of leaving them at liberty to distribute them among the clergy of the diocese in general; and this tract of land, the tithes of which were so appropriated, formed a distinct parish; and this accounts for the frequent intermixture of parishes one with another. For if a lord had a parcel of land detached from the main of his estate, but not sufficient to form a parish of itself, it was natural for him to endow his newly erected church with the tithes of such lands. Extra-parochial wastes and marsh lands, when improved and drained, are by 17 Geo. II. cap. 37. to be assessed to all parochial rates in the parish next adjoining. Camden reckons 9284 parishes in England; and Chamberlayne makes 9913. They are now generally reckoned about 10,000.

*Parish Clerk.* In every parish the parson, vicar, &c. hath a parish clerk under him, who is the lowest officer of the church. These were formerly clerks in orders, and their business at first was to officiate at the altar; for which they had a competent maintenance by offerings; but they are now laymen, and have certain fees with the parson on christenings, marriages, burials, &c. besides wages for their maintenance. The law looks upon them as officers for life: and they are chosen by the minister of the parish, unless there is a custom for the parishioners or churchwardens to choose them; in which case the canon cannot abrogate such custom; and when chosen it is to be signified, and they are to be sworn into their office by the archdeacon, for which the court of king's bench will grant a mandamus.

PARISII (anc. geog.), a people of Gallia Celtica, inhabiting the country about the Sequana and Matrona. Now a great part of the Isle of France.—*Parisii* (Ptolemy), a people of Britain, having the Brigantes to the north and west, the German sea to the east, and the Coritani to the south, from whom they were separated by the Humber. Now *Holdernesse*, a peninsula of the East Riding of Yorkshire.

PARISIORUM civitas. See Lutetia.

PARIUM (anc. geog.), a noble city of Mysia Minor, with a port on the Propontis; called *Adrastia* by Homer, according to Pliny; but Strabo distinguishes them: according to others, the *Paestos* of Homer. *Pariani*, the people (Strabo). The birthplace of Neoptolemus surnamed *Glossographus* (Strabo). Here stood a Cupid equal in exquisite workmanship to the Cnidian Venus.

PARK (French *parque*, i. e. *locus inclusus*), is a large quantity of ground enclosed and privileged for wild beasts of chase, by the king's grant or prescription. See Chase and Forest.

Manwood defines a chase to be "a privileged place, for beasts of venery, and other wild beasts of the forest and chase, *tam sylvestres, quam campestres;*" and differs from a chase or warren, in that it must be enclosed: for if it lies open, it is good cause of seizure into the king's hands, as a thing forfeited; as a free chase is, if it be enclosed: besides, the owner cannot have an action against such as hunt in his park, if it lies open. No man can erect a park without licence under the broad seal; for the common law does not encourage matter of pleasure, which brings no profit to the commonwealth. But there may be a park in reputation erected without any lawful warrant; and the owner may bring his action against persons killing his deer.



To a park three things are required. 1. A grant thereof. 2. Enclosures by pale, wall, or hedge, 3. Beasts of a park; such as the buck, doe, &c. And where all the deer are destroyed, it shall no more be accounted a park; for a park consists of vert, venison, and enclosure: and if it is determined in any of them, it is a total disparking.

Parks as well as chases are subject to the common law, and are not to be governed by the forest laws.

Park, as connected with gardening. See Gardening.

A park and a garden are more nearly allied than a farm and a garden †, and can therefore be accommodated to each other without any disparagement to either. A farm loses some of its characteristic properties by the connexion, and the advantage is on the part of the garden: but a park thus bordered retains all its own excellencies; they are only enriched, not counteracted, by the intermixture. The most perfect composition of a place that can be imagined, consists of a garden opening into a park, with a short walk through the latter to a farm, and ways along its glades to ridings in the country; but to the farm and the ridings the park is no more than a passage; and its woods and its buildings are but circumstances in their views; its scenes can be communicated only to the garden.

† See *Farm* and *Gardening*.

The affinity of the two subjects is so close, that it would be difficult to draw the exact line of separation between them. Gardens have lately encroached very much both in extent and in style on the character of a park; but still there are scenes in the one which are out of the reach of the other. The small sequestrated spots which are agreeable in a garden would be trivial in a park; and the spacious lawns which are among the noblest features of the latter, would in the former fatigue by their want of variety; even such as, being of a moderate extent, may be admitted into either, will seem bare and naked, if not broken in the one; and lose much of their greatness, if broken in the other. The proportion of a part to the whole is a measure of its dimensions: it often determines the proper size for an object, as well as the space fit to be allotted to a scene; and regulates the style which ought to be assigned to either.

But whatever distinctions the extent may occasion between a park and a garden, a state of highly cultivated nature is consistent with each of their characters; and may in both be of the same kind, though in different degrees.

The excellencies both of a park and of a garden are happily blended at Hagley (A), where the scenes are equally

(A) Near Stourbridge, in Worcestershire, the seat of Lord Lyttelton.

equally elegant and noble. It is situated in the midst of a fertile and lovely country, between the Clent and the Witchberry hills; neither of which are within the pale, but both belong to the place. The latter rise in three beautiful swells. One of them is covered with wood; another is an open sheep walk, with an obelisk on the summit; on the third, the portico of the temple of Theseus, exactly on the model of that at Athens, and little less in the dimensions, stands boldly out upon the brow, backed by the dark ground of a fir plantation, and has a most majestic appearance above the steeps which fall before and beside it. The house is seen to the greatest advantage from these eminences, and every point of them commands some beautiful prospect. The busy town of Stourbridge is just below them; the ruins of Dudley castle rise in the offskip; the country is full of industry and inhabitants; and a small portion of the moor, where the minerals, manufactured in the neighbourhood, are dug, breaking in upon the horizon, accounts for the richness, without derogating from the beauty, of the landscape. From the Clent hills the views are still greater: they extend on one side to the black mountains in Wales, a long ridge which appears, at 60 miles distance, in the interval between the unwieldy heap of the Malvern hills and the solitary peak of the Wrekin, each 30 miles off, and as many asunder. The smoke of Worcester, the churches in Birmingham, and the houses in Stourbridge, are distinctly visible. The country is a mixture of hill and dale, and strongly enclosed; except in one part, where a heath, varied by rising grounds, pieces of water, and several objects, forms an agreeable contrast to the cultivation which surrounds it. From the other extremity of the Clent hills, the prospect is less extensive; but the ground is more rude and broken; it is often overspread with large and beautiful woods; and the view is dignified with numerous seats. The hills also being very irregular, large advanced promontories frequently interrupt the sight, and vary the scene: in other parts, deep valleys shelving down towards the country below, exhibit the objects there in different lights. In one of these hollows is built a neat cottage, under a deep descent, sheltered besides by plantations, and presenting ideas of retirement in the midst of so much open exposure; from the heights above it, is seen all that view which before was commanded from the Witchberry hills, but which is seen here over Hagley park; a noble fore ground, beautiful in itself, and completing the landscape.

The house, though low in the park, is yet above the adjacent country, which it overlooks to a very distant horizon. It is surrounded by a lawn of fine uneven ground, and diversified with large clumps, little groups, and single trees. It is open in front, but covered on one side by the Witchberry hills; on the other side, and behind, by the eminences in the park, which are high and steep, and all overspread with a lofty hanging wood. The lawn pressing to the foot, or creeping up the slopes of these hills, and sometimes winding along glades into the depth of the wood, traces a beautiful outline to a sylvan scene, already rich to luxuriance in massiness of foliage and stateliness of growth.

But though the wood appears to be entire, it in reality opens frequently into lawns, which occupy much of the space within it. In the number, the variety, and the beauty of these lawns, in the shades of the separation between them, in their beauties also, and their varieties, the glory of Hagley consists. No two of the openings are alike in dimensions, in shape, or in character. One is of no more than five or six acres; another of not less than fifty; and others are of all the intermediate sizes. Some stretch out into lengthened glades; some widen every way: they are again distinguished by buildings, by prospects, and often by the style only of the plantations around them. The boundary of one is described by a few careless lines; that of another is composed of many parts, very different, and very irregular: and the ground is never flat; but falls sometimes in steep descents, sometimes in gentle declivities, waves along easy swells, or is thrown into broken inequalities, with endless variety.

An octagon seat, sacred to the memory of Thomson, and erected on his favourite spot, stands on the brow of a steep; a mead winds along the valley beneath, till it is lost on either hand behind some trees. Opposite to the seat, a noble wood crowns the top, and feathers down to the bottom of a large oval swelling hill. As it descends on one side, the distant country becomes the offskip. Over the fall, on the other side, the Clent hill appears. A dusky antique tower stands just below them, at the extremity of the wood; and in the midst of it is seen a Doric portico, called *Pope's Building*, with part of the lawn before it. The scene is very simple: the principal features are great; they prevail over all the rest, and are intimately connected with each other.

The next opening is small, circling about a rotunda on a knoll, to the foot of which the ground rises every way. The trees which surround it are large; but their foliage is not very thick; and their stems appearing beneath, their ramifications between the boughs are, in so confined a spot, very distinguished and agreeable circumstances. It is retired; has no prospect; no visible outlet but one, and that is short and narrow, to a bridge with a portico upon it, which terminates a piece of water.

The grove behind the rotunda separates this from a large, airy, forest glade, thinly skirted with wood, careless of dress, and much overgrown with fern. The wildness is an acceptable relief in the midst of so much elegance and improvement as reign in the neighbouring lawns: and the place is in itself pleasant; in no part confined; and from a Gothic seat at the end is a perspective view of that wood and tower which were seen before in front, together with the Witchberry hills, and a wide range of country.

The tower, which in prospect is always connected with wood, stands however, on a piece of down, which stretches along the broad ridge of a hill, and spreads on each hand for some way down the sides. Thick groves catch the falls. The descent on the right is soon lost under the trees; but that on the left being steeper and shorter, it may be followed to the bottom. A wood hangs on the declivity, which is continued in the valley beneath. The tower overlooks the whole: it seems and remains of a castle, partly entire, partly in ruins, the partly overgrown with bushes. A finer situation cannot be imagined: It is placed in an exposed unfrequented spot; commands an extensive prospect; and is everywhere an interesting object.

 At the end of the valley below it in an obſcure corner, and ſhut out from all view, is a hermitage, compoſed of roots and of moſs: high banks, and a thick covert darkened with horſe cheſnuts, confine the ſequeſtered ſpot: a little rill trickles through it, and two ſmall pieces of water occupy the bottom. They are ſeen on one ſide through groups of trees; the other is open, but covered with fern. This valley is the extremity of the park; and the Clent hills riſe in all their irregularity immediately above it.

The other deſcent from the caſtle is a long declivity, covered like the reſt with noble woods, in which fine lawns are again emboſomed, differing ſtill from the former, and from each other. In one, the ground is very rough, the boundary is much broken, and marked only by the trunks of the trees which ſhoot up high before the branches begin. The next is more ſimple; and the ground falls from an even brow into one large hollow, which ſtops towards the glen, where it ſinks into the covert. This has a communication through a ſhort glade, and between two groves, with another called the *Tinian lawn*, from the reſemblance which it is ſaid to bear to thoſe of that celebrated iſland: it is encompaſſed with the ſtatelieſt trees, all freſh and vigorous, and ſo full of leaf, that not a ſtem, not a branch, appears, but large maſſes of foliage only deſcribe an undulating ouline; the effect, however, is not produced by the boughs feathering down to the bottom; they in appearance ſhoot out horizontally, a few feet above the ground, to a ſurpriſing diſtance, and from underneath an edging of ſhade, into which the retreat is immediate at every hour of the day. The verdure of the turf is as luxuriant there as in the open ſpace: the ground gently waves in both over eaſy ſwells and little dips, juſt varying, not breaking, the ſurface. No ſtrong lines are drawn; no ſtriking objects are admitted; but all is of an even temper, all mild, placid, and ſerene; in the gayeſt ſeaſon of the day not more than cheerful, in the ſtilleſt watch of night not gloomy. The ſcene is indeed peculiarly adapted to the tranquillity of the latter, when the moon ſeems to repoſe her light on the thick foliage of the grove, and ſteadily marks the ſhade of every bough. It is delightful then to ſaunter here, and ſee the graſs, and the goſſamer which entwines it, gliſtening with dew; to liſten and hear nothing ſtir, except perhaps a withered leaf dropping gently through a tree; and, ſheltered from the chill, to catch the freſhneſs of the evening air: a ſolitary urn, choſen by Mr Pope for the ſpot, and now inſcribed to his memory, when ſhown by a gleam of moonlight through the trees, fixes that thoughtfulneſs and compoſure to which the mind is inſenſibly led by the reſt of this elegant ſcene.

The Doric portico, which alſo bears his name, though not within ſight, is near: it is placed on the declivity of a hill; and Thomſon's ſeat, with its groves and appendages, are agreeable circumſtances in the proſpect before it. In the valley beneath is fixed a bench, which commands a variety of ſhort views; one is up the aſcent to the portico, and other through openings in the wood to the bridge and the rotunda.

The next lawn is large: the ground is ſteep and irregular, but inclines to one direction, and falls from every ſide into the general declivity: the outline is diverſified by many groups of trees on the ſlopes; and frequent glimpſes of the country are ſeen in perſpective through openings between them. In the brow is a ſeat, in the proudeſt ſituation of all Hagley; it commands a view down the bold ſweep of the lawn, and over a valley filled with the nobleſt trees, up to the heights beyond. One of thoſe heights is covered with a hanging wood; which opens only to ſhow Thomſon's ſeat, and the groves and the ſteeps about it; the others are the Witchberry hills, which ſeem to preſs forward into the landſcape; and the maſſy heads of the trees in the vale, uniting into a continued ſurface, form a broad baſe to the temple of Theſeus, hide the ſwell on which it is built, and crowd up to the very foundation. Farther back ſtands the obeliſk; before it is the ſheep walk; behind it the Witchberry wood. The temple is backed by the firs; and both theſe plantations are connected with that vaſt ſylvan ſcene which overſpreads the other hill and all the intermediate valley. Such extent of wood; ſuch variety in the diſpoſition of it; objects ſo illuſtrious in themſelves, and ennobled by their ſituations, each contraſted to each, every one diſtinct, and all happily united: the parts ſo beautiful of a whole ſo great, ſeen from a charming lawn, and ſurrounded by a delightful country, compoſe all together a ſcene of real magnificence and grandeur. 

The ſeveral lawns are ſeparated by the fineſt trees; which ſometimes grow in airy groves, chequered with gleams of light, and open to every breeze; but more frequently, whoſe great branches meeting or croſſing each other, caſt a deep impenetrable ſhade. Large boughs feathering down often intercept the ſight; or a vacant ſpace is filled with coppice wood, nut, hawthorn, and hornbeam, whoſe tufted heads mixing with the foliage, and whoſe little ſtems cluſtering about the trunks of the trees, thicken and darken the plantation. Here and there the diviſion is of ſuch coppice wood only, which then being leſs conſtrained and oppreſſed, ſprings up ſtronger, ſpreads further, and joins in a low vaulted covering: in other places the ſhade is high, overarched by the talleſt aſh, or ſpreads under the branches of the moſt venerable oaks. They riſe in every ſhape, they are diſpoſed in every form in which trees can grow. The ground beneath them is ſometimes almoſt level; ſometimes a gentle ſwell; but generally very irregular and broken. In ſeveral places, large hollows wind down the ſides of the hills, worn in the ſtormy months by water courſes but worn many ages ago. Very old oaks in the midſt of the channels prove their antiquity: ſome of them are perfectly dry moſt part of the year; and ſome are watered by little rills all the ſummer: they are deep and broad; the ſides are commonly ſteep; often abrupt and hollow; and the trees on the bank ſometimes extend their roots, all covered with moſs, over the channels of the water. Low down in one of theſe glens, under a thick ſhade of horſe cheſnuts, is a plain bench, in the midſt of ſeveral little currents and water falls, running among large looſe ſtones, and the ſtumps of dead trees, with which the ground is broken. On the brink of another glen, which is diſtinguiſhed by a numerous rookery, is a ſeat in a ſtill wilder ſituation, near a deeper hollow, and in a darker gloom: the falls are nearly perpendicular; the roots of ſome of the trees are almoſt bare, from the earth having crumbled away;

away; large boughs of others, sinking with their own weight, seem ready to break from the trunks they belong to; and the finest ash, still growing, lie all aslant the water course below, which, though the stream runs in winter only, yet constantly retains the black tinge of damp, and casts a chill all around.

Gravel walks are conducted across the glens, through the woods, the groves, or the thickets, and along the sides of the lawns, concealed generally from the sight, but always ready for the communication, and leading to the principal scenes. The frequency of these walks, the number and the style of the buildings, and the high preservation in which all the place is kept, give to the whole park the air of a garden. There is, however, one spot more peculiarly adapted to that purpose, and more artificially disposed than the rest; it is a narrow vale, divided into three parts: one of them is quite filled with water, which leaves no room for a path, but thick trees on either side come down quite to the brink; and between them the sight is conducted to the bridge with a portico upon it, which closes the view: another part of this vale is a deep gloom, overhung with large ash and oaks, and darkened below by a number of yews: these are scattered over very uneven ground, and open underneath; but they are encompassed by a thick covert, under which a stream falls, from a stony channel, down a rock; other rills drop into the current, which afterwards pours over a second cascade into the third division of the vale, where it forms a piece of water, and is lost under the bridge. The view from this bridge is a perfect opera scene, through all the divisions of the vale up to the rotunda. Both these buildings, and the other decorations of the spot, are of the species generally confined to a garden. The hermitage also, which has been described, and its appendages, are in a style which does not belong to a park; but through all the rest of the place, the two characters are intimately blended. The whole is one subject; and it was a bold idea to conceive that one to be capable of so much variety; it required the most vigorous efforts of a fertile fancy to carry that idea into execution. See GARDENING.

*PARK of Artillery.* See ARTILLERY.

*PARK of Provisions*, in military affairs, the place where the sutlers pitch their tents in the rear, and sell their provisions to the soldiers. Likewise that place where the bread waggons are drawn up, and where the troops receive their ammunition bread, being the store of the army.

PARKER (Matthew), the second Protestant archbishop of Canterbury, was born at Norwich in the year 1504, the 19th of Henry VII. His father, who was a man in trade, died when our author was about 12 years old; but his mother took special care of his education, and at the age of 17 sent him to Corpus Christi college in Cambridge, where, in 1523, he took his bachelor's degree. In 1527 he was ordained, created master of arts, and chosen fellow of the college. Having obtained a license to preach, he frequently held forth at St Paul's cross in London, and in other parts of the kingdom. In 1533 or 1534 he was made chaplain to Queen Anne Boleyn, who obtained for him the deanery of Stoke Clare in Suffolk, where he founded a grammar school. After the death of the queen, King Henry made him his own chaplain, and in 1541 prebendary of Ely. In 1544, he was, by the king's command, elected master of Corpus Christi college, and the following year vice chancellor of the university. In 1547 he lost the deanery of Stoke, by the dissolution of that college. In the same year he married the daughter of Robert Harlestone, a Norfolk gentleman.



In the year 1552 he was nominated, by Edward VI. to the deanery of Lincoln, which, with his other preferments, enabled him to live in great affluence: but the papist Mary was hardly seated on the throne before he was deprived of every thing he held in the church, and obliged to live in obscurity, frequently changing his place of abode to avoid the fate of the other reformers.

Queen Elizabeth ascended the throne in 1558; and in the following year Dr Parker, from indigence and obscurity, was at once raised to the see of Canterbury (A); an honour which he neither solicited nor desired. In this high station he acted with spirit and propriety. He visited his cathedral and diocese in 1560, 1565, 1570, and 1573. He repaired and beautified his palace at Lambeth at a vast expence. The sum which the repairs of the palace and great hall at Canterbury cost him was upwards of 1400l. sterling, which is at least equal to ten times the sum now-a-days. Both the palace and great hall were in decay, partly through the injuries of time, and partly through that of fire. The hall, built by Archbishop Huber in the 12th century, was famous in history for the great feasts that had been made there by archbishops and abbots in former times; in particular, at the nuptial feasts of King Edward I. in 1290; at the installation of the abbot of St. Austin's in 1309; at the enthronization of George Nevill archbishop of York in 1464; and of Archbishop Warham in 1504, when Edward duke of Buckingham acted as lord high steward of his household; and lastly, for the entertainment given by that archbishop in 1519 to the emperor Charles V. Henry VIII. Queen Catherine, &c. In 1565 Archbishop Parker gave three entertainments in this hall at Whitsuntide (which lasted three days), on Trinity Sunday, and in assize time. At the two first of these the archbishop himself sat in the midst of the uppermost table; on his left hand the mayor, &c. and so

(A) He was consecrated December 17. 1559, in Lambeth Chapel, by Barlow bishop of Chichester, Scory bishop of Hereford, Coverdale bishop of Exeter, and Hodgkin suffragan bishop of Bedford. This deserves to be particularly mentioned, because the Romanists asserted afterwards that he had been consecrated at the Nag's head inn or tavern in Cheapside. But this notorious and improbable falsehood hath been fully confuted by Mason, in his Vindication of the Church of England concerning the Consecration and Ordination of Bishops, 1613, folio; by Bramhall, in his Consecration of Protestant Bishops vindicated; and by Courayer, in his Defence of the Validity of English Ordinations, 1728, 3 vols. 8vo; and even by many Catholics.

Parker.

so on one side of the hall a continued row of men according to their rank filled the other tables; and on his right hand sat only some noble women and ladies of quality, the whole length of the hall, corresponding to the row of men on the other side: which order of placing the women was observed in honour of the queen. The first rank of guests being risen, and the tables cleared, they were furnished again, and filled the second time. At the last feast, which was grander than all the rest, the archbishop entertained the two judges who went that circuit (B), the attorney-general, the high-sheriff, with all who met at these assizes, as justices of the peace, advocates, and common lawyers, and all the rest of proctors and attorneys; who all (with a promiscuous company) in troops came in. The hall was set forth with much plate of silver and gold, adorned with much tapestry of Flanders; and dainties of all sorts were served in excellent order by none but the archbishop's servants, the table being often the same day furnished afresh with new guests: while the ladies were nobly entertained in inner parlours by Mrs Parker, the hall being now filled only with gentlemen. Otherwise, at these feasts, it was the archbishop's custom, in honour of matrimony, to entertain both men and their wives. Of this noble hall and palace, now within 200 years, there is little or nothing left except a few ruins. On Whitsunday 1570, and the two following days, this archbishop feasted the citizens of Canterbury and their wives in the same manner as he had done before: and on Trinity Sunday (after consecrating Bishop Curteis of Chichester) he made another most archiepiscopal feast, inviting another archbishop (viz. Grindal of York, who came thither for confirmation) to be his guest: besides whom were present Horn bishop of Winchester, and Curteis aforesaid of Chichester. At the lower tables sat all the ministers and servants whatsoever, even the children, who belonged to that church; and at the remotest tables, but in the same hall, in sight, sat the poor of both sexes of the hospitals of St John's and Harbledown. On July 11th, being assizes time, the judges, high-sheriff, gentlemen, and the common sort, were all feasted by the archbishop in a splendid manner as before. Soon after Bishop Sandys of Worcester, elect of London, came to Canterbury to be confirmed. The archbishop, on his return, lodged the first night at Sittingbourn, and the next night (after dining at Gravesend) came to Lambeth in barges by Thames, with all his family. Sept. 7. 1573, being Q. Elizabeth's birth-day, Archbishop Parker entertained her majesty, and as many noblemen, &c. as were present at Archbishop Warham's entertainment in the same hall 54 years before. The archbishop (to use his own words, in a letter to Archbishop Grindal of York) "met her highness, as she was coming to Dover, upon Folkstone Down. I left her at Dover, and came home to Bekesborn that night; and after that went to Canterbury to receive her majesty there. Which I did, with the bishops of Lincoln and Rochester, and my suffragan [of Dover], at the west door; where, after the grammarian had made his oration to her upon her horse-back, she alighted. We then kneeled down, and said the psalm *Deus misereatur*, in English, with certain other collects briefly; and that in our chimers and rochets. The quire, with the dean and prebendaries, stood on either side of the church, and brought her majesty up with a song; she going under a square canopy, borne by four of her temporal knights, to her traverse, placed by the communion board, where she heard evening song; and after departed to her lodging at St Austin's, whither I waited upon her. From thence I brought certain of the council, and divers of the court, to my house to supper, and gave them 14 or 15 dishes, furnished with two mess, at my long table, whereat sat about 20; and in the same chamber a third mess, at a square table, whereat sat 10 or 12; my less hall having three long tables furnished with my officers, and with the guard, and others of the court: and so her majesty came every Sunday to church to hear the sermon. And upon one Monday it pleased her highness to dine in my great hall, thoroughly furnished with the council, Frenchmen, ladies, gentlemen, and the mayor of the town, with his brethren, &c.; her highness sitting in the midst, having two French ambassadors [Gondius and Mothe-Fenelon] at the end of the table, and four ladies of honour at the other end. And so three mess were served by her nobility at washing, her gentlemen and guard bringing her dishes, &c." On which the archbishop of York, in his answer, made this reflection: "Your grace's large description of the entertainment at Canterbury did so lively set forth the matter, that in reading thereof I almost thought myself to be one of your guests there, and as it were beholding the whole order of all things done there. Sir, I think it shall be hard for any of our coat to do the like for one hundred years, and how long after God knoweth." In this progress Lord Treasurer Burleigh was lodged with Mr Pearson, the eleventh prebendary, who, the archbishop says, "had a fine house."

He founded several scholarships in Bennet or Corpus-Christi college in Cambridge, and gave large presents of plate to that and to other colleges in this university. He gave 100 volumes to the public library. He likewise founded a free school at Rochdale in Lancashire. He too care to have the fees filled with pious and learned men; and, considering the great want of Bibles in many places, he, with the assistance of other learned men, improved the English translation, had it printed on a large paper, and dispersed through the kingdom. This worthy prelate died in the year 1575, aged 72, and was buried in his own chapel at Lambeth. He was pious without affectation or austerity, cheerful and contented in the midst of adversity, moderate in the height of power, and beneficent beyond example. He wrote several books; and also published four of our best historians; *Matthew of Westminster*, *Matthew Paris*, *Asser's Life of King Alfred*, and *Tho. Walsingham*. The learned archbishop also translated the Psalter. This version was printed, but without a name; and has been

 attributed

(B) This proves that the judges of assize then came to Canterbury, though it was then a county in itself, being so made in 1461.

Parker. attributed to an obfcure poet of the name of Keeper. This was Wood's opinion; but it is more than probable that the learned author of the *Athenæ Oxon.* was wrong. See Gentleman's Magazine for 1781, p. 566. where Parker is proved to be the author of a verfion of the Pfalms.

Parker (Samuel), an Englifh clergyman, who, by a temporizing fpirit, aided by excellent parts and confiderable learning, raifed himfelf to the bifhopric of Oxford. He was born September 1640, at Northampton, where his father John then practifed the law. John had been bred to that profeffion, in one of the temples at London; and, being afterwards againft the king, was made a member of the high court of juftice in 1649, where he gave fentence againft the three lords, Capel, Holland, and Hamilton, who were beheaded. During Cromwell's ufurpation, he was made an affiftant committee man for his county. In 1650 he publifhed a book in defence of the new government, as a commonwealth, without a king or houfe of lords. June 1655, when Cromwell was declared protector, he was appointed a commiffioner for removing obftructions at Worcefter houfe in the Strand, near London, and was fworn ferjeant at law next day. January 1659, he was appointed one of the barons of the exchequer by the Rump parliament; but, upon a complaint againft him, was quickly difplaced. However, he was again regularly made ferjeant at law, on the recommendation of Chancellor Hyde, at the firft call after the Reftoration. In the mean time, he carefully educated his fon Samuel among the Puritans in Northampton; whence, being fit for the univerfity, he was fent to Wadham college in Oxford, and admitted, in 1659, under a Prefbyterian tutor. Here he led a ftrict and religious life, entered into a weekly fociety, then called the *Gruellers*, becaufe (as Wood obferves) their chief diet was watergruel; and it was obferved that he put more graves in his porridge than all the reft. They fafted and prayed, and met at a houfe at Halywell, where he was fo zealous and conftant at prayers, fermons, and facraments, that he was efteemed one of the moft precious young men in the univerfity. He took the degree of A. B. February 28. 1659-60. Upon the Reftoration, he hefitated what fide to take; but continuing publicly to fpeak againft Epifcopacy, he was much difcountenanced by the new warden Dr Blandford, who had been appointed to that office upon the dawn of the Reftoration in 1659. Upon this he removed to Trinity college, where, by the advice of Dr Ralph Ruthwell, then a fenior fellow of that fociety, he was refcued from the prejudices of an unhappy education, which in fact he publicly avowed in print. He then became a zealous Anti-puritan, and for many years acted the part of what was then called a true fon of the church. In this temper, having taken the degree of M. A. in 1663, he entered into holy orders, reforted frequently to London, and became chaplain to a nobleman; continuing to difplay his wit upon his old friends the Prefbyterians, Independents, &c.

In 1665, he publifhed fome Philofophical Effays, and was elected a member of the Royal Society; thefe Effays, he dedicated to Sheldon archbifhop of Canterbury, who became his patron; and in 1667 made him his chaplain. Being thus in the road to preferment, he left Oxford, and refided at Lambeth, under the eye of his patron; who, in 1670, made him archdeacon of Canterbury, in the room of Dr Sancroft, afterwards archbifhop. November the fame year, he put himfelf in the train of William prince of Orange, who vifited Cambridge, and had the degree of D. D. conferred upon him there. November 1672, he was inftalled a prebendary of Canterbury; and was made rector of Ickham and Chatham in Kent by the archbifhop much about the fame time. He was very obfequious to the court during the reign of Charles II. and upon the acceffion of his brother to the throne, he continued the fame fervile complaifance; and he foon reaped the fruits of it in the bifhopric of Oxford, to which he was appointed by James II. on the death of Dr Fell in 1686, being allowed to hold the archdeaconry of Canterbury in commendam. He was likewife made a privy counfellor, and conftituted by a royal mandamus prefident of Magdalen college in Oxford. Thefe favours, however, were the price of his religion, which he fcrupled not to offer up a facrifice to his ambition. In this new change, he became one of the Romifh mercenaries, proftituting his pen in defending tranfubftantiation, and the worfhip of faints and images. The Papifts made fure of him as a profelyte; one of whom fays that he even propofed in council, whether it was not expedient, that at leaft one college in Oxford fhould be allowed Catholics, that they might not be forced to be at fuch charges, by going abroad to ftudy. In the fame way, having invited two Popifh noblemen, and one of the church of England, to an entertainment, he drank the king's health, wifhing a happy fuccefs to all his affairs; adding, that the Proteftant religion in England feemed to him to be in no better a condition than that of Buda was before it was taken, and that they were next to Atheifts who dared to defend that faith. Nay, fo fhameful was his conduct, that the cooler among the Romanifts condemned it as too hot and precipitate. For example, Father Peter, a Jefuit, and privy counfellor to King James, in a letter to Father la Chaife, confeffor to Louis XIV. writes thus: "The bifhop of Oxford has not yet declared himfelf openly; the great obftacle is his wife, whom he cannot rid himfelf of; his defign being to continue a bifhop, and only change communion, as it is not doubted but the king will permit, and our holy father confirm; though I don't fee how he can be farther ufeful to us in the religion he is in; becaufe he is fufpected, and of no efteem among the heretics of the Englifh church: nor do I fee that the example of his converfion is like to draw many others after him, becaufe he declared himfelf fo fuddenly. If he had believed my counfel, which was to temporize for fome longer time, he would have done better; but it is his temper, or rather zeal, that hurried him on to it." Accordingly his authority in his diocefe was fo very infignificant, that when he affembled his clergy, and defired them to fubfcribe an "Addrefs of Thanks to the King for his Declaration of Liberty of Confcience," they rejected it fo unanimoufly, that he got but one clergyman to concur with him in it. Bifhop Burnet reprefents him to be a man of no judgment, and of as little virtue; and as to religion rather impious: that he was covetous and ambitious, and feemed to have no other fenfe of religion but as a political intereft, and

Parker ‖ Parliament

a ſubject of party and faction. He ſeldom came to prayers, or to any exerciſes of devotion; and was ſo proud, that he grew inſufferable to all that came near him. (But this muſt be read with caution.) No doubt but the ill ſucceſs he met with, in puſhing on the deſign to introduce Popery, ruined him, as well as his royal maſter: the latter loſt his crown by it, and the biſhop his life; for, falling into contempt with all good men, trouble of mind threw him into a diſtemper, of which he died unlamented at Magdalen college, March 20. 1687. He ſent, however, a Diſcourſe to James, perſuading him to embrace the Proteſtant religion, with a Letter to the ſame purpoſe, which was printed at London in 1690, 4to. He wrote ſeveral pieces, in all which Burnet allows that there was an entertaining livelineſs; though at the ſame time he accompanies that favourable cenſure, as his manner is, with a "But it was neither grave nor correct." Yet Dr Nichols's remark cannot be diſputed, and may be extended to the preſent time, "that he has but few readers at this day." And Swift obſerves, that Marvell's remarks on Parker continued to be read, when the book which occaſioned them was long ago ſunk. He left a ſon, Samuel, an excellent ſcholar, and of ſingular modeſty; who married a bookſeller's daughter at Oxford, where he reſided with a numerous family of children; to ſupport which, he publiſhed ſome books, with a modeſt Vindication of his father. One of his ſons is now, or was lately, a bookſeller at Oxford.

PARKINSONIA, ſo called in honour of the Engliſh botaniſt *Parkinſon:* A genus of the monogynia order, belonging to the decandria claſs of plants; and in the natural method it ranks under the 33d order, *Lomentaceæ.* The calyx is quinquefid; there are five petals, all of them oval except the loweſt, which is reniform; there is no ſtyle; the legumen moniliform, or like ſtrong beads. We know but one ſpecies of this plant, which is very common in the Spaniſh Weſt Indies, but has of late years been introduced into the Engliſh ſettlements, for the beauty and ſweetneſs of its flowers. In the countries where it grows naturally, it riſes to be a tree of 20 or more feet high, and bears long ſlender bunches of yellow flowers; which have a moſt agreeable ſweet ſcent.

PARLEY, a conference with an enemy. Hence, to beat or ſound a parley, is to give a ſignal for holding ſuch a conference by beat of drum, or ſound of trumpet.

Definition.

PARLIAMENT, the grand aſſembly of the three ſtates of this kingdom, ſummoned together by the king's authority, to conſider of matters relating to the public welfare, and particularly to enact and repeal laws.

Origin not certainly known.

The original or firſt inſtitution of parliament is one of thoſe matters which lie ſo far hidden in the dark ages of antiquity, that the tracing of it out is a thing equally difficult and uncertain. The word *parliament* itſelf (or *colloquium,* as ſome of our hiſtorians tranſlate it) is, comparatively, of modern date; derived from the French, and ſignifying "the place where they met and conferred together." It was firſt applied to general aſſemblies of the ſtates under Lewis VII. in France, about the middle of the 12th century. But it is certain, that long before the introduction of the Norman language into England, all matters of importance were debated and ſettled in the great councils of the realm. A practice which ſeems to have been univerſal among the northern nations, particularly the Germans; and carried by them into all the countries of Europe, which they overran at the diſſolution of the Roman empire. Relicks of which conſtitution, under various modifications and changes, are ſtill to be met with in the diets of Poland, Germany, and Sweden, and lately in the aſſembly of the eſtates in France: for what is there now called the *parliament,* is only the ſupreme court of juſtice, conſiſting of the peers, certain dignified eccleſiaſtics, and judges; which neither is in practice, nor is ſuppoſed to be in theory, a general council of the realm.

3 Antiquity of, in England

In England, however, this general council hath been held immemorially, under the ſeveral names of *michel-ſynoth,* or "great council;" *michel-gemote* or "great meeting;" and more frequently *wittena-gemote,* or "the meeting of wiſe men." It was alſo ſtyled in Latin, *commune concilium regni, magnum concilium regis, curia magna, conventus magnatum vel procerum aſſiſa generalis,* and ſometimes *communitas regni Angliæ.* We have inſtances of its meeting to order the affairs of the kingdom, to make new laws, and to amend the old, or, as Fleta expreſſes it, *novis injuriis emerſis nova conſtituere remedia,* ſo early as the reign of Ina king of the Weſt Saxons, Offa king of the Mercians, and Ethelbert king of Kent, in the ſeveral realms of the heptarchy. And after their union, the Mirrour informs us, that King Alfred ordained for a perpetual uſage, that theſe councils ſhould meet twice in the year, or oftener, if need be, to treat of the government of God's people; how they ſhould keep themſelves from ſin, ſhould live in quiet, and ſhould receive right. Our ſucceeding Saxon and Daniſh monarchs held frequent councils of this ſort, as appears from their reſpective codes of laws; the titles whereof uſually ſpeak them to be enacted, either by the king with the advice of his *wittena-gemote,* or wiſe men, as, *Hæc ſunt inſtituta, quæ Edgarus rex conſilio ſapientium ſuorum inſtituit;* or to be enacted by thoſe ſages with the advice of the king; as, *Hæc ſunt judicia, quæ ſapientes conſilio regis Ethelſtani inſtituerunt;* or, laſtly, To be enacted by them both together, as *Hæ ſunt inſtitutiones, quas rex Edmundus et epiſcopi ſui cum ſapientibus ſuis inſtituerunt.*

There is alſo no doubt but theſe great councils were occaſionally held under the firſt princes of the Norman line. Glanvil, who wrote in the reign of Henry II. ſpeaking of the particular amount of an amercement in the ſheriff's court, ſays, it had never yet been aſcertained by the general aſſize or aſſembly, but was left to the cuſtom of particular counties. Here the general aſſize is ſpoken of as meeting well known, and its ſtatutes or deciſions are put in a manifeſt contradiſtinction to cuſtom, or the common law. And in Edward III.'s time, an act of parliament, made in the reign of William the Conqueror, was pleaded in the caſe of the abbey of St Edmund's Bury, and judicially allowed by the court.

Hence it indiſputably appears, that parliaments, or general councils, are coeval with the kingdom itſelf. How thoſe parliaments were conſtituted and compoſed,

Parliament. ed, is another question, which has been matter of great dispute among our learned antiquarians; and particularly, whether the commons were summoned at all; or, if summoned, at what period they began to form a distinct assembly. But without entering into controversies of this sort, it may be sufficient to observe, that it is generally agreed, that in the main the constitution of parliament, as it now stands, was marked out so long ago as the 17th year of King John, A. D. 1215, in the great charter granted by that prince; wherein he promises to summon all archbishops, bishops, abbots, earls, and greater barons, personally; and all other tenants in chief under the crown, by the sheriff and bailiffs; to meet at a certain place, with 40 days notice, to assess aids and scutages when necessary. And this constitution has subsisted in fact at least from the year 1266, 49 Henry III. there being still extant writs of that date, to summon knights, citizens, and burgesses, to parliament. We proceed therefore to inquire wherein consists this constitution of parliament, as it now stands, and has stood, for the space of at least 500 years. And in the prosecution of this inquiry, we shall consider, first, The manner and time of its assembling: Secondly, Its constituent parts: Thirdly, The laws and customs relating to parliament: Fourthly, The methods of proceeding, and of making statutes, in both houses: And, lastly, The manner of the parliament's adjournment: prorogation, and dissolution.

The nature of these early parliaments not easily known.

5 Parliament summoned only by the king.

I. *As to the manner and time of assembling.* The parliament is regularly to be summoned by the king's writ or letter, issued out of chancery by advice of the privy council, at least 40 days before it begins to sit. It is a branch of the royal prerogative, that no parliament can be convened by its own authority, or by the authority of any, except the king alone. And this prerogative is founded upon very good reason. For, supposing it had a right to meet spontaneously, without being called together, it is impossible to conceive that all the members, and each of the houses, would agree unanimously upon the proper time and place of meeting: and if half of the members met, and half absented themselves, who shall determine which is really the legislative body, the part assembled, or that which stays away? It is therefore necessary, that the parliament should be called together at a determinate time and place; and, highly becoming its dignity and independence, that it should be called together by none but one of its own constituent parts: and, of the three constituent parts, this office can only appertain to the king; as he is a single person, whose will may be uniform and steady; the first person in the nation, being superior to both houses in dignity; and the only branch of the legislature that has a separate existence, and is capable of performing any act at a time when no parliament is in being. Nor is it an exception to this rule, that, by some modern statutes, on the demise of a king or queen, if there be then no parliament in being, the last parliament revives, and is to sit again for six months, unless dissolved by the successor: for this revived parliament must have been originally summoned by the crown.

It is true, that the convention parliament which restored King Charles II. met above a month before his return; the lords by their own authority, and the commons in pursuance of writs issued in the name of the keepers of the liberty of England by authority of parliament; and that the said parliament sat till the 29th of December, full seven months after the Restoration; and enacted many laws, several of which are still in force. But this was for the necessity of the thing, which supersedes all law; for if they had not so met, it was morally impossible that the kingdom should have been settled in peace. And the first thing done after the king's return was, to pass an act declaring this to be a good parliament, notwithstanding the defect of the king's writ. So that as the royal prerogative was chiefly wounded by their so meeting, and as the king himself, who alone had a right to object, consented to wave the objection, this cannot be drawn into an example in prejudice of the rights of the crown. Besides, we should also remember, that it was at that time a great doubt among the lawyers, whether even this healing act made it a good parliament, and held by very many in the negative; though it seems to have been too nice a scruple. And yet, out of abundant caution, it was thought necessary to confirm its acts in the next parliament, by statute 13 Car. II. c. 7. and c. 14.

Parliament. 6 The convention parliament no just exception to this;

It is likewise true, at the time of the Revolution, A. D. 1688, the lords and commons by their own authority, and upon the summons of the prince of Orange (afterwards King William), met in a convention, and therein disposed of the crown and kingdom. But it must be remembered, that this assembling was upon a like principle of necessity as at the Restoration; that is, upon a full conviction that King James II. had abdicated the government, and that the throne was thereby vacant: which supposition of the individual members was confirmed by their concurrent resolution, when they actually came together. And, in such a case as the palpable vacancy of a throne, it follows, *ex necessitate rei*, that the form of the royal writs must be laid aside, otherwise no parliament can ever meet again. For let us put another possible case, and suppose, for the sake of argument, that the whole royal line should at any time fail, and become extinct, which would indisputably vacate the throne: in this situation it seems reasonable to presume, that the body of the nation, consisting of lords and commons, would have a right to meet and settle the government; otherwise there must be no government at all. And upon this and no other principle did the convention in 1688 assemble. The vacancy of the throne was precedent to their meeting without any royal summons, not a consequence of it. They did not assemble without writ, and then make the throne vacant; but, the throne being previously vacant by the king's abdication, they assembled without writ, as they must do if they assembled at all. Had the throne been full, their meeting would not have been regular: but, as it was really empty, such meeting became absolutely necessary. And accordingly it is declared by statute 1 W. & M. stat. 1. c. 1. that this convention was really the two houses of parliament, notwithstanding the want of writs or other defects of form. So that, notwithstanding these two capital exceptions, which were justifiable only on a principle of necessity (and each of

7 nor that of 1688, because they originated *ex necessitate rei.*

(which,

Parliament. which, by the way, induced a revolution in the government), the rule laid down is in general certain, that the king only can convoke a parliament.

8 The king is obliged to convoke parliament as often as circumſtances require.

And this, by the ancient ſtatutes of the realm, he is bound to do every year, or oftener if need be. Not that he is, or ever was, obliged by theſe ſtatutes to call a new parliament every year; but only to permit a parliament to ſit annually for the redreſs of grievances, and deſpatch of buſineſs, if need be. Theſe laſt words are ſo looſe and vague, that ſuch of our monarchs as were inclined to govern without parliaments, neglected the convoking them, ſometimes for a very conſiderable period, under pretence that there was no need of them. But, to remedy this, by the ſtatute 16 Car. II. c. 1. it is enacted, that the ſitting and holding of parliaments ſhall not be intermitted above three years at the moſt. And by the ſtatute 1 W. & M. ſt. 2. c. 2. it is declared to be one of the rights of the people, that for redreſs of all grievances, and for the amending, ſtrengthening, and preſerving, the laws, parliaments ought to be held frequently. And this indefinite frequency is again reduced to a certainty by ſtatute 6 W & M. c. 2. which enacts, as the ſtatute of Charles II. has done before, that a new parliament ſhall be called within three years after the determination of the former.

9 The king, lords ſpiritual and temporal, and commons, make the parliament.

II. *The conſtituent parts of a parliament are*, the king's majeſty, ſitting there in his royal political capacity, and the three eſtates of the realm; the lords ſpiritual, the lords temporal (who ſit together with the king in one houſe), and the commons, who ſit by themſelves in another. And the king and theſe three eſtates together form the greater corporation or body politic of the kingdom, of which the king is ſaid to be *caput, principium, et finis*. For upon their coming together the king meets them, either in perſon or by repreſentation; without which there can be no beginning of a parliament; and he alſo has alone the power of diſſolving them.

10 The propriety and neceſſity of the king's being a branch of the legiſlature.

It is highly neceſſary for preſerving the balance of the conſtitution, that the executive power ſhould be a branch, though not the whole, of the legiſlature. The total union of them, we have ſeen, would be productive of tyranny; the total disjunction of them, for the preſent, would in the end produce the ſame effects, by cauſing that union againſt which it ſeems to provide. The legiſlature would ſoon become tyrannical, by making continual encroachments, and gradually aſſuming to itſelf the rights of the executive power. Thus the long parliament of Charles I. while it acted in a conſtitutional manner, with the royal concurrence, redreſſed many heavy grievances and eſtabliſhed many ſalutary laws. But when the two houſes aſſumed the power of legiſlation, in excluſion of the royal authority, they ſoon after aſſumed likewiſe the reins of adminiſtration; and, in conſequence of theſe united powers, overturned both church and ſtate, and eſtabliſhed a worſe oppreſſion than any they pretended to remedy. To hinder therefore any ſuch encroachments, the king is himſelf a part of the parliament; and as this is the reaſon of his being ſo, very properly therefore the ſhare of legiſlation which the conſtitution has placed in the crown, conſiſts in the power of rejecting, rather than reſolving; this being ſufficient to anſwer the end propoſed. For we may apply to the royal negative, in this inſtance, what Cicero obſerves of the negative of the Roman tribunes, that the crown has not any power of doing wrong, but merely of preventing wrong from being done. The crown cannot begin of itſelf any alterations in the preſent eſtabliſhed law; but it may approve or diſapprove of the alterations ſuggeſted and conſented to by the two houſes. The legiſlature therefore cannot abridge the executive power of any rights which it now has by law, without its own conſent; ſince the law muſt perpetually ſtand as it now does, unleſs all the powers will agree to alter it. And herein indeed conſiſts the true excellence of the Britiſh government, that all the parts of it form a mutual check upon each other. In the legiſlature, the people are a check upon the nobility, and the nobility a check upon the people, by the mutual privilege of rejecting what the other has reſolved; while the king is a check upon both, which preſerves the executive power from encroachments. And this very executive power is again checked and kept within due bounds by the two houſes, through the privilege they have of inquiring into, impeaching, and puniſhing the conduct (not indeed of the king, which would deſtroy his conſtitutional independence; but which is more beneficial to the public) of his evil and pernicious counſellors. Thus every branch of our civil polity ſupports and is ſupported, regulates and is regulated, by the reſt: for the two houſes naturally drawing in two directions of oppoſite intereſt, and the prerogative in another ſtill different from them both, they mutually keep each other from exceeding their proper limits; while the whole is prevented from ſeparation, and artificially connected together by the mixed nature of the crown, which is a part of the legiſlative, and the ſole executive magiſtrate. Like three diſtinct powers in mechanics, they jointly impel the machine of government in a direction different from what either, acting by itſelf, would have done; but at the ſame time in a direction partaking of each, and formed out of all; a direction which conſtitutes the true line of the liberty and happineſs of the community.

Having already conſidered theſe conſtituent parts of the ſovereign power, or parliament, each in a ſeparate view, under the articles KING, LORDS, and COMMONS, to which the reader is referred, we proceed,

11 The power of parliament.

III. To examine the laws and cuſtoms relating to parliament, united together and conſidered as one aggregate body. The power and juriſdiction of parliament, ſays Sir Edward Coke, is ſo tranſcendent and abſolute, that it cannot be confined either for cauſes or perſons within any bounds. And of this high court he adds, it may be truly ſaid, *Si antiquitatem ſpectes, eſt vetuſtiſſima; ſi dignitatem, eſt honoratiſſima; ſi juriſdictionem, eſt capaciſſima*. It hath ſovereign and uncontroulable authority in making, confirming, enlarging, reſtraining, abrogating, repealing, reviving, and expounding of laws, concerning matters of all poſſible denominations, eccleſiaſtical or temporal, civil, military, maritime, or criminal: this being the place where that abſolute deſpotic power, which muſt in all governments reſide ſomewhere, is intruſted by the conſtitution of theſe kingdoms. All miſchiefs and grievances, operations and remedies, that tranſcend the ordinary courſe of the laws, are within the reach of

this extraordinary tribunal. It can regulate or new-model the succession to the crown; as was done in the reign of Henry VIII. and William III. It can alter the established religion of the land; as was done in a variety of instances in the reigns of King Henry VIII. and his three children. It can change and create afresh even the constitution of the kingdom and of parliaments themselves; as was done by the act of Union, and the several statutes for triennial and septennial elections. It can, in short, do every thing that is not naturally impossible; and therefore some have not scrupled to call its power, by a figure rather too bold, the *omnipotence of parliament*. True it is, that what the parliament doth, no authority upon earth can undo. So that it is a matter most essential to the liberties of this kingdom, that such members be delegated to this important trust as are most eminent for their probity, their fortitude, and their knowledge; for it was a known apophthegm of the great lord treasurer Burleigh, "That England could never be ruined but by a parliament; and, as Sir Matthew Hale observes, this being the highest and greatest court, over which none other can have jurisdiction in the kingdom, if by any means a misgovernment should anyway fall upon it, the subjects of this kingdom are left without all manner of remedy. To the same purpose the President Montesquieu, though we trust too hastily, presages, that as Rome, Sparta, and Carthage, have lost their liberty and perished; so the constitution of England will in time lose its liberty, will perish: it will perish whenever the legislative power shall become more corrupt than the executive.

12
Mr Locke opinion respecting this power.

It must be owned, that Mr Locke, and other theoretical writers, have held, that "there remains still inherent in the people a supreme power to remove or alter the legislature, when they find the legislature act contrary to the trust reposed in them: for when such trust is abused, it is thereby forfeited, and devolves to those who gave it." But however just this conclusion may be in theory, we cannot adopt it, nor argue from it, under any dispensation of government at present actually existing. For this devolution of power, to the people at large, includes in it a dissolution of the whole form of government established by that people; reduces all the members to their original state of equality; and by annihilating the sovereign power, repeals all positive laws whatsoever before enacted. No human laws will therefore suppose a case, which at once must destroy all law, and compel men to build afresh upon a new foundation; nor will they make provision for so desperate an event, as must render all legal provisions ineffectual. So long therefore as the English constitution lasts, we may venture to affirm, that the power of parliament is absolute and without controul.

13
The qualifications of members.

In order to prevent the mischiefs that might arise, by placing this extensive authority in hands that are either incapable or else improper to manage it, it is provided by the custom and law of parliament, that no one shall sit or vote in either house, unless he be 21 years of age. This is also expresly declared by statute 7 & 8 W. III. c. 25. with regard to the house of commons, doubts have arisen, from some contradictory adjudications, whether or not a minor was incapacitated from sitting in that house. It is also enacted by statute 7 Jac. I. c. 6. that no member be permitted to enter the house of commons till he hath taken the oath of allegiance before the lord steward or his deputy: and by 30 Car. II. st. 2. and 1 Geo. I. c. 13. that no member shall vote or sit in either house, till he hath, in the presence of the house, taken the oaths of allegiance, supremacy, and abjuration, and subscribed and repeated the declaration against transubstantiation, and invocation of saints, and the sacrifice of the mass. Aliens, unless naturalized, were likewise by the law of parliament incapable to serve therein: and now it is enacted, by statute 12 & 13 W. III. c. 2. that no alien, even though he be naturalized shall be capable of being a member of either house of parliament. And there are not only these standing incapacities; but if any person is made a peer by the king, or elected to serve in the house of commons by the people, yet may the respective houses, upon complaint of any crime in such person, and proof thereof, adjudge him disabled and incapable to sit as a member: and this by the law and custom of parliament.

14
The customs of parliament which are not sanctioned by express laws.

For as every court of justice hath laws and customs for its direction, some the civil and canon, some the common law, others their own peculiar laws and customs; so the high court of parliament hath also its own peculiar law, called the *lex et consuetudo parliamenti;* a law which Sir Edward Coke observes is *ab omnibus quærenda, à multis ignorata, à paucis cognita.* It will not therefore be expected that we should enter into the examination of this law with any degree of minuteness; since, as the same learned author assures us, it is much better to be learned out of the rolls of parliament and other records, and by precedents and continual experience, than can be expressed by any one man. It will be sufficient to observe, that the whole of the law and custom of parliament has its original from this one maxim, "That whatever matter arises concerning either house of parliament, ought to be examined, discussed, and adjudged in that house to which it relates, and not elsewhere." Hence, for instance, the lords will not suffer the commons to interfere in settling the election of a peer of Scotland; the commons will not allow the lords to judge of the election of a burgess; nor will either house permit the subordinate courts of law to examine the merits of either case. But the maxims upon which they proceed, together with the method of proceeding, rest entirely in the breast of the parliament itself; and are not defined and ascertained by any particular stated laws.

15
Its extensive privileges.

The privileges of parliament are likewise very large and indefinite; and therefore, when in 31st Hen. VI. the house of lords propounded a question to the judges concerning them, the chief justice, Sir John Fortescue, in the name of his brethren, declared, "That they ought not to make answer to that question; for it hath not been used aforetime, that the justices should in anywise determine the privileges of the high court of parliament; for it is so high and mighty in its nature, that it may make law; and that which is law, it may make no law; and the determination and knowledge of that privilege belongs to the lords of parliament, and not to the justices." Privilege of parliament was principally established, in order to protect its members not only from being molested by their fellow-subjects, but also more especially from being op-

Parliament. pressed by the power of the crown. If therefore all the privileges of parliament were once to be set down and ascertained, and no privilege to be allowed but what was so defined and determined, it were easy for the executive power to devise some new case, not within the line of privilege, and under pretence thereof to harass any refractory member, and violate the freedom of parliament. The dignity and independence of the two houses are therefore in great measure preserved by keeping their privileges indefinite. Some, however, of the more notorious privileges of the members of either house are, privileges of speech, of person, of their domestics, and of their lands and goods. As to the first, privilege of speech, it is declared by the statute 1 W. and M. st. 2. c. 2. as one of the liberties of the people, "That the freedom of speech, and debates, and proceedings in parliament, ought not to be impeached or questioned in any court or place out of parliament." And this freedom of speech is particularly demanded of the king in person, by the speaker of the house of commons, at the opening of every new parliament. So likewise are the other privileges, of person, servants, lands, and goods; which are immunities as ancient as Edward the Confessor: in whose laws we find this precept, *ad synodos venientibus, sive summoniti sint, sive per se quid agendum habuerint, sit summa pax;* and so too in the old Gothic constitutions, *Extenditur hæc pax et securitas ad quatuordecim dies, convocato regni senatu.* This included formerly not only privilege from illegal violence, but also from legal arrests and seizures by process from the courts of law. And still to assault by violence a member of either house, or his menial servants, is a high contempt of parliament, and there punished with the utmost severity. It has likewise peculiar penalties annexed to it in the courts of law by the statutes 5 Hen. IV. c. 6. and 11 Hen. VI. c. 11. Neither can any member of either house be arrested and taken into custody without a breach of the privilege of parliament.

16 Some privileges abolished.

But all other privileges which derogate from the common law are now at an end, save only as to the freedom of the member's person; which in a peer (by the privilege of peerage) is for ever sacred and inviolable; and in a commoner (by the privilege of parliament) for forty days after every prorogation, and forty days before the next appointed meeting; which is now in effect as long as the parliament subsists, it seldom being prorogued for more than 80 days at a time. As to all other privileges which obstruct the ordinary course of justice, they were restrained by the statutes 12 W. III. c. 3. 2 and 3 Ann. c. 18. and 11 Geo. II. c. 24. and are now totally abolished by statute 10 G. III. c. 50.; which enacts, that any suit may at any time be brought against any peer or member of parliament, their servants, or any other person entitled to privilege of parliament; which shall not be impeached or delayed by pretence of any such privilege, except that the person of a member of the house of commons shall not thereby be subjected to any arrest or imprisonment. Likewise, for the benefit of commerce, it is provided by statute 4 Geo. III. c. 33. that any trader, having privilege of parliament, may be served with legal process for any just debt (to the amount of 100l.): and unless he makes satisfaction within two months, it shall be deemed an act of bankruptcy; and that commissions of bankruptcy may be issued against such privileged traders in like manner as against any other. Parliament.

17 Members may be arrested; but parliament must be informed of it, and of the cause, &c.

The only way by which courts of justice could anciently take cognizance of privilege of parliament was by writ of privilege, in the nature of a *supersedeas*, to deliver the party out of custody when arrested in a civil suit. For when a letter was written by the speaker to the judges, to stay proceedings against a privileged person, they rejected it as contrary to their oath of office. But since the statute 12 Will. III. c. 3 which enacts, that no privileged person shall be subject to arrest or imprisonment, it hath been held, that such arrest is irregular *ab initio*, and that the party may be discharged upon motion. It is to be observed, that there is no precedent of any such writ of privilege, but only in civil suits; and that the statute of 1 Jac. I. c. 13. and that of King William (which remedy some inconveniences arising from privilege of parliament), speak only of civil actions. And therefore the claim of privilege hath been usually guarded with an exception as to the case of indictable crimes; or, as it hath been frequently expressed, of treason, felony, and breach (or surety) of the peace. Whereby it seems to have been understood, that no privilege was allowable to the members, their families, or servants, in any *crime* whatsoever; for all crimes are treated by the law as being *contra pacem domini regis*. And instances have not been wanting, wherein privileged persons have been convicted of misdemeanors, and committed, or prosecuted to outlawry, even in the middle of a session; which proceeding has afterwards received the sanction and approbation of parliament. To which may be added, that a few years ago, the case of writing and publishing seditious libels was resolved by both houses not to be entitled to privilege; and that the reasons upon which that case proceeded, extended equally to every indictable offence. So that the chief, if not the only, privilege of parliament, in such cases, seems to be the right of receiving immediate information of the imprisonment or detention of any member, with the reason for which he is detained: a practice that is daily used upon the slightest military accusations, preparatory to a trial by a court martial; and which is recognized by the several temporary statutes for suspending the *habeas corpus* act: whereby it is provided, that no member of either house shall be detained, till the matter of which he stands suspected be first communicated to the house of which he is a member, and the consent of the said house obtained for his commitment or detaining. But yet the usage has uniformly been, ever since the Revolution, that the communication has been subsequent to the arrest.

These are the general heads of the laws and customs relating to parliament, considered as one aggregate body. The laws and customs relating to each branch in particular being explained under the articles already referred to, viz. KING, LORDS, and COMMONS, we should proceed, IV. To the method of making laws; which is much the same in both houses. But for this, too, we have to refer the reader to the article BILL; and shall only observe in this place, that, for despatch of business, each house of parliament has its speaker. The speaker of the house of lords, whose office it is to preside there, and manage the formality of business, is the lord chancellor, or keeper of the king's great seal, or any other appointed 18

18 Of the lord chancellor and speaker of the house of commons.

Parliament. appointed by the king's commiſſion: and if none be ſo appointed, the houſe of lords (it is ſaid) may elect.—The ſpeaker of the houſe of commons is choſen by the houſe; but muſt be approved by the king. And herein the uſage of the two houſes differs, that the ſpeaker of the houſe of commons cannot give his opinion or argue any queſtion in the houſe; but the ſpeaker of the houſe of lords, if a lord of parliament, may. In each houſe the act of the majority binds the whole; and this majority is declared by votes openly and publicly given; not, as at Venice, and many other ſenatorial aſſemblies, privately, or by ballot. This latter method may be ſerviceable, to prevent intrigues and unconſtitutional combinations; but it is impoſſible to be practiſed with us, at leaſt in the houſe of commons, where every member's conduct is ſubject to the future cenſure of his conſtituents, and therefore ſhould be openly ſubmitted to their inſpection.

19 Of the adjournment of parliament.

V. There remains only, in the laſt place, to add a word or two concerning the manner in which parliament may be *adjourned, prorogued*, or *diſſolved*.

An *adjournment* is no more than a continuance of the ſeſſion from one day to another; as the word itſelf ſignifies; and this is done by the authority of each houſe ſeparately every day; and ſometimes for a fortnight or a month together, as at Chriſtmas or Eaſter, or upon other particular occaſions. But the adjournment of one houſe is no adjournment of the other. It hath alſo been uſual, when his majeſty hath ſignified his pleaſure that both or either of the houſes ſhould adjourn themſelves to a certain day, to obey the king's pleaſure ſo ſignified, and to adjourn accordingly.—Otherwiſe, beſides the indecorum of a refuſal, a prorogation would aſſuredly follow; which would often be very inconvenient to both public and private buſineſs. For prorogation puts an end to the ſeſſion; and then ſuch bills as are only begun, and not perfected, muſt be reſumed *de novo* (if at all) in a ſubſequent ſeſſion; whereas, after an adjournment, all things continue in the ſame ſtate as at the time of the adjournment made, and may be proceeded on without any freſh commencement.

20 Of prorogation of parliament

A *prorogation* is the continuance of the parliament from one ſeſſion to another; as an adjournment is a continuation of the ſeſſion from day to day. This is done by the royal authority, expreſſed either by the lord chancellor in his majeſty's preſence, or by commiſſion from the crown, or frequently by proclamation. Both houſes are neceſſarily prorogued at the ſame time; it not being a prorogation of the houſe of lords or commons, but of the parliament. The ſeſſion is never underſtood to be at an end until a prorogation; though, unleſs ſome act be paſſed, or ſome judgment given in parliament, it is in truth no ſeſſion at all. And formerly the uſage was, for the king to give the royal aſſent to all ſuch bills as he approved at the end of every ſeſſion, and then to prorogue the parliament, though ſometimes only for a day or two; after which all buſineſs then depending in the houſes was to be begun again. Which cuſtom obtained ſo ſtrongly, that it once became a queſtion, Whether giving the royal aſſent to a ſingle bill did not of courſe put an end to the ſeſſion? And though it was then reſolved in the negative, yet the notion was ſo deeply rooted, that the ſtatute 1 Car. I. c. 7. was paſſed to declare, that the king's aſſent to that and ſome other acts ſhould not put an end to the ſeſſion; and even ſo late as the reign of Charles II. we find a proviſo frequently tacked to a bill, that his majeſty's aſſent thereto ſhould not determine the ſeſſion of parliament. But it now ſeems to be allowed, that a prorogation muſt be expreſsly made, in order to determine the ſeſſion. And if at the time of an actual rebellion, or imminent danger of invaſion, the parliament ſhall be ſeparated by adjournment or prorogation, the king is empowered to call them together by proclamation, with 14 days notice of the time appointed for their reaſſembling.

21 Parliament is diſſolved by the king's will,

A *diſſolution* is the civil death of the parliament; and this may be effected three ways: 1. By the king's will, expreſſed either in perſon or by repreſentation. For as the king has the ſole right of convening the parliament, ſo alſo it is a branch of the royal prerogative, that he may (whenever he pleaſes) prorogue the parliament for a time, or put a final period to its exiſtence. If nothing had a right to prorogue or diſſolve a parliament but itſelf, it might happen to become perpetual. And this would be extremely dangerous, if at any time it ſhould attempt to encroach upon the executive power; as was fatally experienced by the unfortunate King Charles I.; who, having unadviſedly paſſed an act to continue the parliament then in being till ſuch time as it ſhould pleaſe to diſſolve itſelf, at laſt fell a ſacrifice to that inordinate power which he himſelf had conſented to give them. It is therefore extremely neceſſary that the crown ſhould be empowered to regulate the duration of theſe aſſemblies, under the limitations which the Engliſh conſtitution has preſcribed: ſo that, on the one hand, they may frequently and regularly come together for the deſpatch of buſineſs and redreſs of grievances; and may not, on the other, even with the conſent of the crown, be continued to an inconvenient or unconſtitutional length.

22 or in conſequence of his death,

2. A parliament may be diſſolved by the demiſe of the crown. This diſſolution formerly happened immediately upon the death of the reigning ſovereign: for he being conſidered in law as the head of the parliament, (*caput, principium, et finis*), that failing, the whole body was held to be extinct. But the calling a new parliament immediately on the inauguration of the ſucceſſor being found inconvenient, and dangers being apprehended from having no parliament in being in caſe of a diſputed ſucceſſion, it was enacted by the ſtatutes 7 and 8 Wm. III. c. 15. and 6 Ann, c. 7. that the parliament in being ſhall continue for ſix months after the death of any king or queen, unleſs ſooner prorogued or diſſolved by the ſucceſſor; that if the parliament be, at the time of the king's death, ſeparated, by adjournment or prorogation, it ſhall notwithſtanding aſſemble immediately: and that if no parliament is then in being, the members of the laſt parliament ſhall aſſemble and be again a parliament.

23 or through length of time.

3. Laſtly, A parliament may be diſſolved or expire by length of time. For if either the legiſlative body were perpetual, or might laſt for the life of the prince who convened them as formerly, and were ſo to be ſupplied, by occaſionally filling the vacancies with new repreſentatives; in theſe caſes, if it were once corrupted, the evil would be paſt all remedy; but when different bodies ſucceed each other, if the people ſee cauſe to diſapprove of the preſent, they may rectify its faults

in

Parliament. in the next. A legiſlative aſſembly alſo, which is ſure to be ſeparated again, (whereby its members will themſelves become private men, and ſubject to the full extent of the laws which they have enacted for others), will think themſelves bound, in intereſt as well as duty, to make only ſuch laws as are good. The utmoſt extent of time that the ſame parliament was allowed to ſit, by the ſtatute 6 W. and M. c. 3. was *three* years: after the expiration of which, reckoning from the return of the firſt ſummons, the parliament was to have no longer continuance. But by the ſtatute 1 Geo. I. ſt. 2. c. 38. (in order, profeſſedly, to prevent the great and continued expences of frequent elections, and the violent heats and animoſities conſequent thereupon, and for the peace and ſecurity of the government then juſt recovering from the late rebellion), this term was prolonged to *ſeven* years; and, what alone is an inſtance of the vaſt authority of parliament, the very ſame houſe that was choſen for three years, enacted its own continuance for ſeven. So that, as our conſtitution now ſtands, the parliament muſt expire, or die a natural death, at the end of every ſeventh year, if not ſooner diſſolved by the royal prerogative.

We ſhall conclude this article with an account of ſome general forms not taken notice of under any of the above heads.

24 General forms obſerved in the houſe of peers.

In the houſe of lords, the princes of the blood ſit by themſelves on the ſides of the throne; at the wall, on the king's right hand, the two archbiſhops ſit by themſelves on a form. Below them, the biſhops of London, Durham, and Wincheſter, and all the other biſhops, ſit according to the priority of their conſecration. On the king's left hand the lord treaſurer, lord preſident, and lord privy ſeal, ſit upon forms above all dukes, except the royal blood; then the dukes, marquiſſes, and earls, according to their creation. Acroſs the room are wool ſacks, continued from an ancient cuſtom; and the chancellor, or keeper, being of courſe the ſpeaker of the houſe of lords, ſits on the firſt wool ſack before the throne, with the great ſeal or mace lying by him; below theſe are forms for the viſcounts and barons. On the other wool ſacks are ſeated the judges, maſters in chancery, and king's council, who are only to give their advice in points of law; but they all ſtand up till the king gives them leave to ſit.

25 In the houſe of commons.

The commons ſit promiſcuouſly; only the ſpeaker has a chair at the upper end of the houſe, and the clerk and his aſſiſtant ſit at a table near him.

When a member of the houſe of commons ſpeaks, he ſtands up uncovered, and directs his ſpeech to the ſpeaker only. If what he ſays be anſwered by another, he is not allowed to reply the ſame day, unleſs perſonal reflections have been caſt upon him: but when the commons, in order to have a greater freedom of debate, have reſolved themſelves into a committee of the whole houſe, every member may ſpeak to a queſtion as often as he thinks neceſſary. In the houſe of lords they vote, beginning at the puiſne, or loweſt baron, and ſo up orderly to the higheſt, every one anſwering, *Content* or *Not content*. In the houſe of commons they vote by *yeas* and *nays*; and if it be dubious which are the greater number, the houſe divides. If the queſtion be about bringing any thing into the houſe, the *yeas* go out, but if it be about any thing the houſe already has, the *nays* go out. In all diviſions the ſpeaker appoints four tellers, two of each opinion. In a committee of the whole houſe, they divide by changing ſides, the *yeas* taking the right and the *nays* the left of the chair; and then there are but two tellers. If a bill paſs one houſe, and the other demur to it, a conference is demanded in the painted chamber, where certain members are deputed from each houſe; and here the lords ſit covered, and the commons ſtand bare, and debate the caſe. If they diſagree, the affair is null: but if they agree, this, with the other bills that have paſſed both houſes, is brought down to the king in the houſe of lords, who comes thither clothed in his royal robes; before him the clerk of the parliament reads the title of each bill, and as he reads, the clerk of the crown pronounces the royal aſſent or diſſent. If it be a public bill, the royal aſſent is given in theſe words, *Le roy le vaut*, "The king will have it ſo;" if private *Soit fait comme il eſt deſiré*, "Let the requeſt be complied with;" if the king refuſes the bill, the anſwer is, *Le roy s'aviſera*, "The king will think of it;" and if it be a money bill, the anſwer is, *Le roy remercie ſes loyaux ſujets, accepte leur benevolence, et auſſi le veut*; "The king thanks his loyal ſubjects, accepts their benevolence, and therefore grants his conſent."

26 Manner of expreſſing the royal aſſent or diſſent to bills.

*High Court of* PARLIAMENT, is the ſupreme court in the kingdom, not only for the making, but alſo for the execution, of laws; by the trial of great and enormous offenders, whether lords or commoners, in the method of parliamentary impeachment. As for acts of parliament to attaint particular perſons of treaſon or felony, or to inflict pains and penalties, beyond or contrary to the common law, to ſerve a ſpecial purpoſe, we ſpeak not of them; being to all intents and purpoſes new laws, made *pro re nata*, and by no means an execution of ſuch as are already in being. But an impeachment before the lords by the commons of Great Britain, in parliament, is a proſecution of the already known and eſtabliſhed law, and has been frequently put in practice; being a preſentment to the moſt high and ſupreme court of criminal juriſdiction by the moſt ſolemn grand inqueſt of the whole kingdom. A commoner cannot, however, be impeached before the lords for any capital offence, but only for high miſdemeanors; a peer may be impeached for any crime. And they uſually (in caſe of an impeachment of a peer for treaſon) addreſs the crown to appoint a lord high ſteward, for the greater dignity and regularity of their proceedings; which high ſteward was formerly elected by the peers themſelves, though he was generally commiſſioned by the king; but it hath of late years been ſtrenuouſly maintained, that the appointment of a high ſteward in ſuch caſes is not indiſpenſably neceſſary, but that the houſe may proceed without one. The articles of impeachment are a kind of bills of indictment, found by the houſe of commons, and afterwards tried by the lords; who are in caſes of miſdemeanors conſidered not only as their own peers, but as the peers of the whole nation. This is a cuſtom derived to us from the conſtitution of the ancient Germans; who in their great councils ſometimes tried capital accuſations relating to the public: *Licet apud concilium accuſare quoque, et diſcrimen capitis intendere*. And it has a peculiar propriety in the Engliſh conſtitution; which has much improved upon the

the ancient model imported hither from the continent. 'For though in general the union of the legislative and judicial powers ought to be most carefully avoided, yet it may happen that a subject, intrusted with the administration of public affairs, may infringe the rights of the people, and be guilty of such crimes as the ordinary magistrate either dares not or cannot punish. Of these the representatives of the people, or house of commons, cannot properly judge; because their constituents are the parties injured, and can therefore only impeach. But before what court shall this impeachment be tried? Not before the ordinary tribunals, which would naturally be swayed by the authority of so powerful an accuser. Reason therefore will suggest, that this branch of the legislature, which represents the people, must bring its charge before the other branch, which consists of the nobility, who have neither the same interests, nor the same passions, as popular assemblies. This is a vast superiority which the constitution of this island enjoys over those of the Grecian or Roman republics; where the people were at the same time both judges and accusers. It is proper that the nobility should judge, to ensure justice to the accused; as it is proper that the people should accuse, to ensure justice to the commonwealth. And therefore, among other extraordinary circumstances attending the authority of this court, there is one of a very singular nature, which was insisted on by the house of commons in the case of the earl of Danby in the reign of Charles II. and is now enacted by statute 12 & 13 W. III. c. 2. that no pardon under the great seal shall be pleadable to an impeachment by the commons of Great Britain in parliament.

Such is the nature of a British parliament, and in theory at least we should presume it were nearly perfect; but some of our fellow countrymen, more zealous perhaps than wise, see prodigious faults in it, such indeed as they think must inevitably prove fatal. The consequence of this persuasion has been a loud and incessant call for parliamentary reform. That abuses ought to be reformed, is certain; and that few institutions are so perfect as not to need amendment, is a fact equally indisputable. We shall even suppose that there are many abuses in our parliament which would require to be amended; but, granting all this, and something more if it were necessary, we would recommend in the mean time to the serious consideration of those who call themselves the *Friends of the People*, whose sincerity in their professions it would be impolite to question, the example of France, and that they would allow it to be a warning to Britain. France wanted reform indeed, and that which was first proposed had the countenance of the coolest and the best of men; but the consequences have been dreadful; and if ever a free and stable government take place in it, which we sincerely wish may be soon, it will have been purchased at an immense price, by enormities which will disgrace it whilst the remembrance of them lasts.

The former *Parliaments of France* were sovereign courts established by the king, finally to determine all disputes between particular persons, and to pronounce on appeals from sentences given by inferior judges.—There were ten of these parliaments in France, of which that of Paris was the chief, its privileges and jurisdiction being of the greatest extent. It consisted of eight chambers: the grand chamber, where causes of audience were pleaded; the chamber of written law; the chamber of counsel; the Tournelle criminelle, for judging criminal affairs; the Tournelle civile, in aid of the grand chamber; and three chambers of inquests, where processes were adjudged in writing: besides these, there was also the chamber of vacations, and those of requests. In 1771 the king thought fit to branch the parliament of Paris into six different parliaments, under the denomination of superior courts, each parliament having similar jurisdiction. Under their second race of kings, this parliament, like that of England, was the king's council; it gave audience to ambassadors, and consulted of the affairs of war and government. The king, like ours, at that time presided in them, without being at all master of their resolutions. But in after times their authority was abridged; as the kings reserved the decision of the grand affairs of the public to their own councils; leaving none but private ones to the parliaments. The parliament of Paris also enjoyed the privileges of verifying and registering the king's arrets or edicts, without which those edicts were of little or no value.



*Parliament of Sweden*, consists of four estates, with the king at their head. These estates are, 1. The nobility and representatives of the gentry; with whom the colonels, lieutenant colonels, majors, and captains of every regiment, sit and vote. 2. The clergy; one of which body is elected from every rural deanery of ten parishes; who, with the bishops and superintendents, amount to about 200. 3. The burghers, elected by the magistrates and council of every corporation as their representatives, of whom there are four for Stockholm, and two for every other town, amounting in the whole to about 150. 4. The peasants, chosen by the peasants out of every district; who choose one of their own rank, and not a gentleman, to represent them: these amount to about 250.

All these generally meet at Stockholm: and after the state affairs have been represented to them from the throne, they separate, and sit in four several chambers or houses, in each of which affairs are carried on by majority of votes; and every chamber has a negative in the passing any law.

PARMA, an ancient, rich, populous, and handsome town of Italy, capital of the duchy of the same name, with a citadel, a bishop's see, and an university. It has a magnificent cathedral, and the largest opera house in Europe, which has seats for 8000 people; but as it required a vast number of candles, which occasioned great expence, they have contrived another which has room for 2000 spectators. The dome and the church of St John are painted by the famous Corregio, who was a native of this place. Don Carlos, king of the two Sicilies, carried away the library to Naples, which contained 18,000 volumes, and a very valuable cabinet of curiosities, as also the rich collection of medals. The citadel, which is very near the city, is built in the same taste as that at Antwerp. In 1734 there was a bloody battle fought here; and in 1741, by the treaty of Aix-la-Chapelle, the duchies of Parma, Placentia, and Guastalla, were given to Don Philip, brother to Don Carlos abovementioned. It is 30 miles south-east of Cremona, and 60 south-east of Milan. E. Long. 10. 51. N. Lat. 44. 50.

Parma, the duchy of, a province of Italy, bounded on the north by the Po; on the north-east by the Mantuan; on the east by the duchy of Modena; on the south by Tuscany; and on the west by the duchy of Placentia. The air is very wholesome, on which account the inhabitants live to a great age. The soil is very fertile, in corn, wine, oil, and hemp; the pastures feed a great number of cattle, and the cheese is in very high esteem. Here are considerable mines of copper and silver, and plenty of truffles, which many are very fond of.

PARMESAN Cheese, a sort of cheese much esteemed among the Italians; so named from the duchy of Parma where it is made, and whence it is conveyed to various parts of Europe.

The excellent pasture grounds of this country are watered by the Po; and the cows from whose milk this cheese is made yield a great quantity of it. Of this cheese there are three sorts; the *fromaggio di forma*, about two palms in diameter, and seven or eight inches thick; and the *fromaggia di ribiole* and *di ribolini*, which are not so large. This cheese is of a saffron colour; and the best is kept three or four years. See Cheese.

PARMIGIANO, a celebrated painter, whose true name was Francesco Mazzuoli; but he received the former from the city of Parma, where he was born, in 1504. He was brought up under his two uncles, and was an eminent painter when but 16 years of age. He was famous all over Italy at 19; and at 23 performed such wonders, that when the general of the emperor Charles V. took Rome by storm, some of the common soldiers having, in sacking the town, broke into his apartments, found him intent upon his work, and were instantly so struck with the beauty of his pieces, that instead of involving him in the plunder and destruction in which they were then employed, they resolved to protect him from all manner of violence; which they actually performed. His works are distinguished by the beauty of the colouring, the invention, and drawing. His figures are spirited and graceful, particularly with respect to the choice of attitude, and in their dresses. He also excelled in music, in which he much delighted.

In large compositions Parmigiano did not always reach a high degree of excellence; but in his holy families, and other similar subjects, the gracefulness of his heads, and the elegance of his attitudes, are peculiarly delightful. For the celebrity of his name he seems to be chiefly indebted to his numerous drawings and etchings; for his life being short, and a great part of it consumed in the idle study of alchemy, in pursuit of the philosopher's stone, and in the seducing avocations of music and gambling, there was but little time left for application to the laborious part of his business. His paintings in oil are few in number, and held in high esteem, as are also his drawings and etchings; good impressions of these last being very rarely to be found. He was the first that practised the art of etching in Italy; and probably he did not at first know that it had been for some years practised in Germany. When he set out for Rome, he was advised to take some of his pictures with him, as a means of getting himself introduced into the acquaintance of the nobility and artists in that celebrated city. One of them is mentioned by his biographers as a masterpiece. It was his own portrait painted upon a piece of wood of a convex form, in imitation of a convex mirror. The surface is said to have been so wonderfully executed, that it had the appearance of real glass, and the head, as well as every part of the furniture of the chamber in which he was supposed to sit, were so artfully managed, that the whole formed a very complete piece of deception. At Rome he was employed by Pope Clement VII. who was highly pleased with his performances, and rewarded him liberally. A circumcision which he painted for him was particularly esteemed as a capital work. In it Parmigiano was successful in introducing a variety of lights, without destroying the general harmony. When Charles V. came to Bologna to be crowned emperor of the Romans, Parmigiano failed not to be present at that singular ceremony; and so accurately marked the countenance of the emperor, that at his return home, he was enabled from memory to make out a surprising likeness. In the same piece he introduced the figure of Fame placing a crown of laurel on the head of the emperor, whilst a young Hercules presented him with a globe of the world. Before it was quite finished, the painter and his piece were introduced to Charles by the Pope, but to little purpose; for the emperor left Bologna a few days after, without ordering him any recompense for his labour. In the church of Madona della Stercato at Parma are still to be seen several of the works of this artist; among which one of Sibyls, and two others of Moses, and of Adam and Eve, are much admired. So also is a Dead Christ, with the Virgin in sorrow, in the church of the Dominicans at Cremona. In the Houghton collection of pictures, now in possession of the empress of Russia, is one of his best pictures, representing Christ laid in the sepulchre, for which he is said to have been knighted by the duke of Parma. His principal works are at Parma, where he died poor in 1540.



PARNASSIA, grass of Parnassus, in botany; a genus of the tetragynia order, belonging to the pentandria class of plants. The calyx is quinquepartite; there are five petals, and as many nectaria, heart-shaped, and ciliated with globular tops; the capsule quadrivalved. There is but one species, having a stalk about a foot high, angular, and often a little twisted, bearing a single white flower at top. The flowers are very beautifully streaked with yellow; so that though it is a common plant, growing naturally in moist pastures, it is frequently admitted into gardens.

PARNASSUS (Strabo, Pindar, Virgil), a mountain of Phocis, near Delphi, and the mounts Cithæron and Helicon, with two tops (Ovid, Lucan); the one called *Cirrha*, sacred to Apollo; and the other *Nisa*, sacred to Bacchus, (Juvenal). It was covered with bay trees (Virgil); and originally called *Larnassus*, from Deucalion's larnax or ark, thither conveyed by the flood, (Stephanus, Scholiast on Apollonius); after the flood, *Parnassus*; from Har Nahas, changing the *h* into *p*, the hill of divination or augury (Peucerus); the oracle of Delphi standing at its foot.

Chandler *, who visited it, thus describes it:—"Parnassus was the western boundary of Phocis, and stretching northward from about Delphi toward the Œtæan

* Travels in Greece.

Parnassus. Œtæan mountains, separated the western Locri from those who possessed the sea coast before Eubœa. It was a place of refuge to the Delphians in times of danger. In the deluge, which happened under Deucalion, the natives were saved on it by following the cry of wolves. On the invasion by Xerxes, some transported their families over to Achaia, but many concealed them in the mountain, and in Corycium, a grotto of the Nymphs. All Parnassus was renowned for sanctity, but Corycium was the most noted among the hallowed caves and places. 'On the way to the summits of Parnassus, says Pausanias, as much as 60 stadia beyond Delphi, is a brazen image; and from thence the ascent to Corycium is easier for a man on foot, and for mules and horses. Of all the caves in which I have been, this appeared to me the best worth seeing. On the coasts, and by the sea side, are more than can be numbered; but some are very famous both in Greece and in other countries. The Corycian cave exceeds in magnitude those I have mentioned, and for the most part may be passed through without a light. It is sufficiently high; and has water, some springing up, and yet more from the roof, which petrifies; so that the bottom of the whole cave is covered with sparry icicles. The inhabitants of Parnassus esteem it sacred to the Corycian Nymphs, and particularly to Pan.—From the cave to reach the summits of the mountain is difficult even to a man on foot. The summits are above the clouds, and the women called *Thyades* madden on them in the rites of Bacchus and Apollo.' Their frantic orgies were performed yearly. Wheler and his company ascended Parnassus from Delphi, some on horses, by a track between the Stadium and the clefts of the mountain. Stairs were cut in the rock, with a strait channel, perhaps a water duct.—In a long hour, after many traverses, they gained the top, and entering a plain turned to the right, towards the summits of Castalia, which are divided by deep precipices. From this eminence they had a fine prospect of the gulf of Corinth, and of the coast; Mount Cirphis appearing beneath them as a plain, bounded on the east by the bay of Asprospitia, and on the west by that of Salona. A few shepherds had huts there. They returned to the way which they had quitted, and crossed a hill covered with pines and snow. On their left was a lake, and beyond it a peak, exceedingly high, white with snow. They travelled to the foot of it through a valley, four or five miles in compass; and rested by a plentiful fountain called *Drosonigo*, the stream boiling up a foot in diameter, and nearly as much above the surface of the ground. It runs into the lake, which is about a quarter of a mile distant to the south-east. They did not discover Corycium, or proceed farther on, but keeping the lake on their right, came again to the brink of the mountain, and descended by a deep and dangerous track to Racovi, a village four or five miles eastward from Delphi. It was the opinion of Wheler, that no mountain in Greece was higher than Parnassus; that it was not inferior to Mount Cenis among the Alps; and that, if detached, it would be seen at a greater distance than even Mount Athos. The summits are perpetually increasing, every new fall of snow adding to the perennial heap, while the sun has power only to thaw the superficies. Castalis Pleistus and innumerable springs are fed, some invisibly, from the lakes and reservoirs, which, without these drains and subterraneous vents, would swell, especially after heavy rain and the melting of snow, so as to fill the valleys, and run over the tops of the rocks down upon Delphi, spreading wide an inundation, similar, as has been surmised, to the Deucalionean deluge."

Parnell, Parody.

PARNELL (Dr Thomas), a very ingenious divine and poet in the early part of this century. He was archdeacon of Clogher, and the intimate friend of Mr Pope; who published his works, with an elegant copy of recommendatory verses prefixed. He died in 1718, aged 39.

Johnson † says, "The life of Dr Parnell is a task which I should very willingly decline, since it has been lately written by Goldsmith, a man of such variety of powers, and such facility of performance, that he always seemed to do best that which he was doing; a man who had the art of being minute without tediousness, and general without confusion; whose language was copious without exuberance, exact without constraint, and easy without weakness.

† *Lives of the Poets.*

"What such an author has told, who would tell again? I have made an extract from his larger narrative; and shall have this gratification from my attempt, that it gives me an opportunity of paying due tribute to the memory of a departed genius.

'Το γαρ γερας εστι θανοντων.'

"The general character of Parnell is not great extent of comprehension, or fertility of mind. Of the little that appears still less is his own. His praise must be derived from the easy sweetness of his diction: in his verses there is more happiness than pains; he is sprightly without effort, and always delights though he never ravishes; every thing is proper, yet every thing seems casual. If there is some appearance of elaboration in the Hermit, the narrative, as it is less airy, is less pleasing. Of his other compositions, it is impossible to say whether they are the productions of Nature so excellent as not to want the help of Art, or of Art so refined as to resemble Nature."

PARODY, a popular maxim, adage, or proverb.

Parody, is also a poetical pleasantry, consisting in applying the verses written on one subject, by way of ridicule, to another; or in turning a serious work into a burlesque, by affecting to observe as near as possible the same rhimes, words, and cadences.

The parody was first set on foot by the Greeks; from whom we borrow the name. It comes near to what some of our late writers call *traversty*. Others have more accurately distinguished between a parody and burlesque; and they observe, that the change of a single word may parody a verse; or of a single letter a word. Thus, in the last case, Cato exposed the inconstant disposition of Marcus Fulvius Nobilior, by changing Nobilior into Mobilior. Another kind of parody consists in the mere application of some known verse, or part of a verse of a writer, without making any change in it, with a view to expose it. A fourth instance is that of writing verses in the taste and stile of authors little approved. The rules of parody regard the choice of a subject, and the manner of treating it. The subject should be a known and celebrated work: as to the manner, it should be by an exact imitation, and an intermixture of good natural pleasantry.

Parole Paros.

PAROLE, in a military ſenſe, the promiſe made by a priſoner of war, when he has leave to go anywhere, of returning at a time appointed, if not exchanged.

Parole, means alſo a word given out every day in orders by the commanding officer, both in camp and garriſon, in order to know friends from enemies.

PARONOMASIA, in rhetoric, a pun; or a figure whereby words nearly alike in ſound, but of very different meanings, are affectedly or deſignedly uſed. See Oratory, N° 76.

PARONYCHIA, the Whitlow, in ſurgery, is an abſceſs at the end of the fingers. According as it is ſituated more or leſs deep, it is differently denominated, and divided into ſpecies.

It begins with a ſlow heavy pain, attended with a ſlight pulſation, without ſwelling, redneſs, or heat: but ſoon the pain, heat, and throbbing, are intolerable; the part grows large and red, the adjoining fingers and the whole hand ſwell up; in ſome caſes, a kind of red and inflated ſtreak may be obſerved, which beginning at the affected part, is continued almoſt to the elbow; nor is it unuſual for the patient to complain of a very ſharp pain under the ſhoulder, and ſometimes the whole arm is exceſſively inflamed and ſwelled; the patient cannot ſleep, the fever, &c. increaſing; and ſometimes delirium or convulſions follow.

I. When it is ſeated in the ſkin or fat, in the back or the fore part of the finger, or under or near the nail, the pain is ſevere, but ends well. 2. When the perioſteum is inflamed or corroded, the pain is tormenting. 3. When the nervous coats of the flexor tendons of the fingers or nerves near them are ſeized, the worſt ſymptoms attend. If the firſt kind ſuppurates, it muſt be opened, and treated as abſceſſes in general; but the beſt method of treating the other two ſpecies is, on the firſt, or at furtheſt the ſecond day, to cut the part where the pain is ſeated quite to the bone: if this operation is longer deferred, a ſuppuration will come on; in which caſe ſuppuration ſhould be ſpeedily promoted, and as early a diſcharge given to the matter as poſſible. As the pain is ſo conſiderable as to occaſion a fever, and ſometimes convulſions, the tinct. theb. may be added to the ſuppurating applications, and alſo given in a draught at bed time. The ſecond ſpecies proves very troubleſome, and ſometimes ends in a caries of the ſubjacent bone. The third ſpecies is very tedious in the cure, and uſually the phalanx on which it is ſeated is deſtroyed.

PAROS (anc. geog.), an iſland of the Ægean ſea, one of the Cyclades, with a ſtrong cognominal town, 38 miles diſtant from Delos (Pliny, Nepos). Anciently called *Pactye* and *Minoa* (Pliny), alſo *Demetrias*, *Zacynthus*, *Hyria*, *Hylceſſa*, and *Cabarnis* (Nicanor). The country of Archilochus the Iambic poet (Strabo). An iſland famous for its white marble (Virgil, Horace, Ovid), called *lychnites*, becauſe dug with lamps (Pliny), The name of Cabarnis is borrowed, according to Stephanus, from one Cabarnus, who firſt informed Ceres of the rape of her daughter Proſerpine; or, according to Heſychius, from the Cabarni, the prieſts of Ceres being ſo called by the inhabitants of this iſland. The name of Minoa is borrowed from Minos king of Crete, who ſubdued this, as he did moſt of the other iſlands of the Ægean ſea. It was called Paros, which name it retains to this day, from Paros the ſon of Parrhaſius, or, as Stephanus will have it, of Jaſon the Argonaut. Paros, according to Pliny's computation, is diſtant from Naxos ſeven miles and a half, and 28 from Delos. Some of the modern travellers will have it to be 80, others only 50 miles in compaſs. Pliny ſays it is half as large as Naxos, that is, between 36 and 37 miles in compaſs. It was a rich and powerful iſland, being termed the moſt wealthy and happy of the Cyclades, and by Cornelius Nepos an iſland elated with its riches. The city of Paros, the metropolis, is ſtyled by Stephanus a potent city, and one of the largeſt in the Archipelago: the preſent city of Paros, now Parichia, is ſuppoſed to have been built upon its ruins, the country abounding with valuable monuments of antiquity. The very walls of the preſent city are built with columns, architraves, pedeſtals, mingled with pieces of ancient marble of a ſurpriſing magnitude, which were once employed in more noble edifices. Paros was indeed formerly famous for its marble, which was of an extraordinary whiteneſs, and in ſuch requeſt among the ancients that the beſt ſtatuaries uſed no other (A). The iſland is provided with ſeveral capacious and ſafe harbours, and was anciently much reſorted to by traders. It was, according to Thucydides, originally peopled by the Phœnicians, who were the firſt maſters of the ſea. Afterwards the Carians ſettled here, as we are told by Thucydides and Diodorus. But theſe two authors differ as to the time when the Carians came firſt into the iſland; for Thucydides tells us, that the Carians were driven out by the Cretans under the conduct of Minos; and Diodorus writes, that the Carians did not ſettle here till after the Trojan war, when they found the Cretans in poſſeſſion of the iſland. Stephanus thinks that the Cretans, mixed with ſome Arcadians, were the only people that ever poſſeſſed this iſland. Minos himſelf if we believe Pliny, reſided ſome time in the iſland of Paros, and received here the melancholy news of the death of his ſon Androgeus, who was killed in Attica after

(A) Sutherland ſays, "that while its marble quarries continued to be worked, Paros was one of the moſt flouriſhing of the Cyclades; but on the decline of the eaſtern empire they were entirely neglected, and are now converted into caves, in which the ſhepherds ſhelter their flocks. We have been in ſeveral of theſe ſubterraneous folds, which put me much in mind of Homer's deſcription of Polyphemus. The common walls are almoſt entirely compoſed of marble; and in examining a very ſmall part of one, we found ſeveral pieces of cornice and baſſo relievo. Several fine blocks of marble; (fragments of columns) are lying cloſe to the water's edge; and ſeem to have been brought there by travellers, who for want of a proper purchaſe to get them on board, have not been able to carry them further."

after he had distinguished himself at the public games. We find the inhabitants of this island chosen from among all the Greeks by the Milesians to compose the differences which had for two generations rent that unhappy state into parties and factions. They acquitted themselves with great prudence, and reformed the government. They assisted Darius in his expedition against Greece with a considerable squadron; but after the victory obtained by Miltiades at Marathon, they were reduced to great straits by that general. However, after blocking up the city for 26 days, he was obliged to quit the enterprise, and return to Athens with disgrace. Upon his departure, the Parians were informed that Timo, a priestess of the national gods, and then his prisoner, had advised him to perform some secret ceremony in the temple of Ceres, near the city; assuring him that he would thereby gain the place. Upon this information they sent deputies to consult the oracle of Delphi, whether they should punish her with death, for endeavouring to betray the city to the enemy, and discovering the sacred mysteries to Miltiades. The Pythian answered, that Timo was not the advisor; but that the gods, having resolved to destroy Miltiades, had only made her the instrument of his death. After the battle of Salamis, Themistocles subjected Paros and most of the other neighbouring islands to Athens, exacting large sums from them by way of punishment for having favoured the Persians. It appears from the famous monument of Adulas, which Cosmos of Egypt has described with great exactness, that Paros and the other Cyclades were once subject to the Ptolemies of Egypt. However, Paros fell again under the power of the Athenians, who continued masters of it till they were driven out by Mithridates the Great. But that prince being obliged to yield to Sylla, to Lucullus, and to Pompey, this and the other islands of the Archipelago submitted to the Romans, who reduced them to a province with Lydia, Phrygia, and Caria.

Mr Sutherland, who lately visited Paros, says, that "the water in it is excellent; and as that which we got at Messina has been complained of, as being too hard to make proper pease soup for the people, all the casks are ordered to be emptied and refilled. The Russians made this place their grand arsenal; their powder magazines, and several other buildings, are still standing; and the island is considerably indebted to them for improving the convenience for water, and for the trade which the cash they expended introduced among the inhabitants."

PAROTIDES, in anatomy. See there, N° 128.

PAROXYSM, in medicine, the severe fit of a disease, under which it grows higher or exasperated; as of the gout, &c.

PARR (Catharine), was the eldest daughter of Sir Thomas Parr of Kendall. She was first married to John Nevil, Lord Latymer; after whose death she so captivated her amorous sovereign, that he raised her to the throne. The royal nuptials were solemnized at Hampton Court on the 12th of July 1543. Being religiously disposed, she was, in the early part of her life, a zealous observer of the Romish rites and ceremonies; but in the dawning of the Reformation, she became as zealous a promoter of the Lutheran doctrine; yet with such prudence and circumspection as her perilous situation required. Nevertheless, we are told, that she was in great danger of falling a sacrifice to the Popish faction, the chief of whom was Bishop Gardiner: he drew up articles against her, and prevailed on the king to sign a warrant to remove her to the Tower. This warrant was, however, accidentally dropped, and immediately conveyed to her majesty. What her apprehensions must have been on this occasion may be easily imagined. She knew the monarch, and she could not help recollecting the fate of his former queens. A sudden illness was the natural consequence. The news of her indisposition brought the king to her apartment. He was lavish in expressions of affection, and sent her a physician. His majesty being soon after also somewhat indisposed, she prudently returned the visit; with which the king seemed pleased, and began to talk with her on religious subjects, proposing certain questions, concerning which he wanted her opinion. She answered, that such profound speculations were not suited to her sex; that it belonged to the husband to choose principles for his wife; the wife's duty was, in all cases, to adopt implicitly the sentiments of her husband: and as to herself, it was doubly her duty, being blessed with a husband who was qualified, by his judgment and learning, not only to choose principles for his own family, but for the most wise and knowing of every nation. "Not so, by St Mary," replied the king; "you are now become a doctor, Kate, and better fitted to give than receive instruction." She meekly replied, that she was sensible how little she was entitled to these praises; that though she usually declined not any conversation, however sublime, when proposed by his majesty, she well knew that her conceptions could serve to no other purpose than to give him a little momentary amusement; that she found the conversation a little apt to languish when not revived by some opposition, and she had ventured sometimes to feign a contrariety of sentiments, in order to give him the pleasure of refuting her; and that she also proposed, by this innocent artifice, to engage him into topics whence she had observed, by frequent experience, that she reaped profit and instruction. "And is it so, sweetheart?" replied the king; "then we are perfect friends again." He embraced her with great affection, and sent her away with assurances of his protection and kindness.

The time being now come when she was to be sent to the Tower, the king, walking in the garden, sent for the queen, and met her with great good humour; when lo the chancellor, with forty of the guards, approached. He fell upon his knees, and spoke softly with the king, who called him knave, arrant knave, beast, fool, and commanded him instantly to depart. Henry then returned to the queen, who ventured to intercede for the chancellor: "Ah, poor soul," said the king, "thou little knowest how evil he deserveth this grace at thy hands. Of my word, sweetheart, he hath been toward thee an arrant knave; and so let him go." The king died in January 1547, just three years and a half after his marriage with this second Catharine; who in a short time was again espoused to Sir Thomas Seymour lord-admiral of England: for in September

September 1548 ſhe died in childbed. The hiſtorians of this period generally inſinuate that ſhe was poiſoned by her huſband, to make way for his marriage with the Lady Elizabeth.

That Catharine Parr was beautiful is beyond a doubt: that ſhe was pious and learned is evident from her writings: and that her prudence and ſagacity were not inferior to her other accompliſhments, may be concluded from her holding up the paſſion of a capricious tyrant as a ſhield againſt her enemies; and that at the latter end of his days, when his paſſions were enfeebled by age, and his peeviſh auſterity increaſed by diſeaſe. She wrote, 1. Queen Catharine Parr's lamentation of a ſinner, bewailing the ignorance of her blind life; Lond. 8vo, 1548, 1563. 2. Prayers or meditations, wherein the mynd is ſtirred patiently to ſuffre all afflictions here, to ſet at nought the vaine proſperitee of this worlde, and always to long for the everlaſtynge felicitee. Collected out of holy workes, by the moſt virtuous and gracious princeſſe Katherine, Queen of Englande, France, and Irelande. Printed by John Wayland, 1545, 4to,—1561, 12mo. 3. Other Meditations, Prayers, Letters, &c. unpubliſhed.

Parr (Thomas), or *Old Parr*, a remarkable Engliſhman, who lived in the reigns of ten kings and queens; married a ſecond wife when he was 120, and had a child by her. He was the ſon of John Parr, a huſbandman of Winnington, in the pariſh of Alderbury, in the county of Salop, where he was born in the year 1483. Though he lived to the vaſt age of upwards of 152 years, yet the tenor of his life admitted but of little variety; nor can the detail of it be conſidered of importance, further than what will ariſe from the gratification of that curioſity which naturally inquires after the mode of living which could lengthen life to ſuch extreme old age. Following the profeſſion of his father, he laboured hard, and lived on coarſe fare. Taylor the water poet ſays of him:

Good wholeſome labour was his exerciſe,
Down with the lamb, and with the lark would riſe;
In mire and toiling ſweat he ſpent the day,
And to his team he whiſtled time away:
The cock his night-clock, and till day was done,
His watch and chief ſun-dial was the ſun.
He was of old Pythagoras' opinion,
That green cheeſe was moſt wholeſome with an onion;
Coarſe meſlin bread, and for his daily ſwig,
Milk, butter-milk, and water, whey and whig:
Sometimes metheglin, and by fortune happy,
He ſometimes ſipp'd a cup of ale moſt nappy,
Cyder or perry, when he did repair
T' a Whitſun ale, wake, wedding, or a fair,
Or when in Chriſtmas time he was a gueſt
At his good landlord's houſe amongſt the reſt:
Elſe he had little leiſure time to waſte,
Or at the alehouſe huff-cap ale to taſte.
Nor did he ever hunt a tavern fox;
Ne'er knew a coach, tobacco, or the——.
His phyſic was good butter, which the ſoil
Of Salop yields, more ſweet than Candy oil;
And garlic he eſteem'd above the rate
Of Venice treacle, or beſt mithridate.
He entertain'd no gout, no ache he felt,
The air was good and temperate where he dwelt;
While maviſſes and ſweet-tongu'd nightingales
Did chant him roundelays and madrigals.
Thus living within bounds of Nature's laws,
Of his long laſting life may be ſome cauſe.

And the ſame writer deſcribes him in the following two lines:

From head to heel, his body had all over
A quick ſet, thick ſet, natural hairy cover.

The manner of his being conducted to London is alſo noticed in the following terms: "The Right Hon. Thomas Earl of Arundel and Surrey, earl marſhal of England, on being lately in Shropſhire to viſit ſome lands and manors which his lordſhip holds in that county, or for ſome other occaſions of importance which cauſed his lordſhip to be there, the report of this aged man was ſignified to his honour, who hearing of ſo remarkable a piece of antiquity, his lordſhip was pleaſed to ſee him; and in his innate, noble, and Chriſtian piety, he took him into his charitable tuition and protection, commanding that a litter and two horſes (for the more eaſy carriage of a man ſo feeble and worn with age) to be provided for him; alſo, that a daughter of his, named Lucy, ſhould likewiſe attend him, and have a horſe for her own riding with him: and to cheer up the old man, and make him merry, there was an antique-faced fellow, with a high and mighty no-beard, that had alſo a horſe for his carriage. Theſe were all to be brought out of the country to London by eaſy journeys, the charge being allowed by his lordſhip; likewiſe one of his lordſhip's own ſervants, named Bryan Kelly, to ride on horſeback with them, and to attend and defray all manner of reckonings and expences. All which was done accordingly as follows:—

"Winnington is a pariſh of Alderbury, near a place called the Welch Pool, eight miles from Shrewſbury; from whence he was carried to Wem, a town of the earl's aforeſaid; and the next day to Shiffnall, a manor-houſe of his lordſhip's, where they likewiſe ſtayed one night: from Shiffnall they came to Wolverhampton, and the next day to Birmingham, and from thence to Coventry. Although Maſter Kelly had much to do to keep the people off, that preſſed upon him in all places where he came, yet at Coventry he was moſt oppreſſed, for they came in ſuch multitudes to ſee the old man, that thoſe that defended him were almoſt quite tired and ſpent, and the aged man in danger of being ſtifled; and, in a word, the rabble were ſo unruly, that Bryan was in doubt he ſhould bring his charge no farther; ſo greedy are the vulgar to hearken to or gaze after novelties. The trouble being over, the next day they paſſed to Daintree, to Stony Stratford, to Radburne, and ſo to London; where he was well entertained and accommodated with all things, having all the aforeſaid attendance at the ſole charge and coſt of his lordſhip." When brought before the king, his majeſty, with more acuteneſs than good manners, ſaid to him, "You have lived longer than other men, what have you done more than other men?" He anſwered, "I did penance when I was a hundred years old." This journey, however, proved fatal to him; owing to the alteration in his diet, to the change of the air, and his general mode of life, he lived but a very ſhort time, dying the 5th of November 1635;

Parr. 1635 (A); and was buried in Westminister Abbey. After his death, his body was opened; and an account was drawn up by the celebrated Dr Harvey, part of which we shall lay before our readers.

"Thomas Parr was a poor country man of Shropshire, whence he was brought up to London by the Right Hon. Thomas earl of Arundel and Surry; and died after he had outlived nine princes, in the tenth year of the tenth of them, at the age of 152 years and nine months.

"He had a large breast, lungs not fungous, but sticking to his ribs, and distended with blood; a lividness in his face, as he had a difficulty of breathing a little before his death, and a long lasting warmth in his armpits and breast after it; which sign, together with others, were so evident in his body, as they use to be on those that die by suffocation. His heart was great, thick, fibrous, and fat. The blood in the heart blackish and diluted. The cartilages of the sternum not more bony than in others, but flexile and soft. His viscera were sound and strong, especially the stomach; and it was observed of him, that he used to eat often by night and day, though contented with old cheese, milk, coarse bread, small beer, and whey; and, which is more remarkable, that he ate at midnight a little before he died. His kidneys were covered with fat, and pretty sound; only on the interior surface of them were found some aqueous or serous abscesses, whereof one was near the bigness of a hen egg, with a yellowish water in it, having made a roundish cavity, impressed on that kidney; whence some thought it came that a little before his death a suppression of urine had befallen him; though others were of opinion, that his urine was suppressed upon the regurgitation of all the serosity into his lungs. Not the least appearance there was of any stony matter either in the kidneys or bladder. His bowels were also sound, a little whitish without. His spleen very little, hardly equalling the bigness of one kidney. In short, all his inward parts appeared so healthy, that if he had not changed his diet and air, he might perhaps have lived a good while longer. The cause of his death was imputed chiefly to the change of food and air; forasmuch as coming out of a clear, thin, and free air, he came into the thick air of London; and after a constant plain and homely country diet, he was taken into a splendid family, where he fed high and drank plentifully of the best wines, whereupon the natural functions of the parts of his body were overcharged, his lungs obstructed, and the habit of the whole body quite disordered; upon which there could not but ensue a dissolution. His brain was sound, entire, and firm; and though he had not the use of his eyes, nor much of his memory, several years before he died, yet he had his hearing and apprehension very well; and was able, even to the 130th year of his age, to do any husbandman's work, even thrashing of corn."

The following summary of his life is copied from Oldy's MS. notes on Fuller's Worthies: Old Parr was born 1483; lived at home until 1500, æt. 17, when he went out to service. 1518, æt. 35, returned home from his master. 1522, æt. 39, spent four years on the remainder of his father's lease. 1543, æt. 60, ended the first lease he renewed of Mr Lewis Porter. 1563, æt. 80, married Jane, daughter of John Taylor, a maiden; by whom he had a son and a daughter, who both died very young. 1564, æt. 81, ended the second lease which he renewed of Mr John Porter. 1585, æt. 102, ended the third lease he had renewed of Mr Hugh Porter. 1588, æt. 105, did penance in Alderbury church, for lying with Katharine Milton, and getting her with child. 1595, æt. 112, he buried his wife Jane, after they had lived 32 years together. 1605, æt. 122, having lived 10 years a widower, he married Jane, widow of Anthony Adda, daughter of John Lloyd of Gilsells, in Montgomeryshire, who survived him. 1635, æt. 152, he died; after they had lived together 30 years, and after 50 years possession of his last lease. See LONGEVITY.

Parra. PARRA, in ornithology, a genus of birds belonging to the order of grallæ; the characters of which are: The bill is tapering and a little obtuse; the nostrils are oval, and situated in the middle of the bill; the forehead is covered with fleshy caruncles, which are lobated; the wings are small, and spinous. There are five species; of which the most remarkable is the chavaria, which is about the size of the domestic cook. The Indians in the neighbourhood of Carthagena, who breed large flocks of poultry that stray in the woods, train up the chavaria to defend them against the numerous birds of prey, no one of which will dare to encounter it. It is never known to desert the flock, and it returns every evening to roost.

The parra Dominica is about the size of the lapwing. The bill is yellow, as are also the head and upper parts; the under are of a yellowish white bordering on rose colour. The legs are also yellow. This species inhabits several of the warmer parts of America and St Domingo. The parra senegalla is about the same size with the former. Its bill is also yellow tipped with black: the forehead is covered with a yellow skin; the chin and throat are black; the head and upper parts of the body and lesser wing coverts are gray brown. The lower part of the belly, and the upper and under tail coverts are dirty white. At the bend of the wing is a black spur. It inhabits Senegal, and thence derives its name. The negroes call them *Uett Uett*, the French the *squallers*, because, as we are told, as soon as they see a man they scream and fly off. They always fly in pairs. The parra jacana, or spur winged water hen, is about the size of the water rail. The bill is in length about an inch and a quarter, of an orange colour; and on the forehead is a membranous flap half an inch long and nearly as broad. On each side of the head also is another of the same, about a quarter of an inch broad, and both together they surround the base of the bill. The head, throat, neck, breast, and under parts,

(A) The author of a book entitled *Long Livers*, 8vo, 1722, which Oldy's in his MS. notes on Fuller ascribes to one Robert Samber, against all evidence says, p. 89, that Parr died sixteen years after he had been presented to the king, 24th of November 1651.

Parra. parts, are black; and sometimes the belly is mixed with white, &c. The birds of this species inhabit Brasil, Guiana, and Surinam; but are equally common at St Domingo, where they frequent the marshy places, sides of ponds, and streams, and wade quite up to the thighs in the water. They are also generally seen in pairs, and when separated call each other continually till they join again. They are very shy, and most common in the rainy seasons in May and November. They are at all times very noisy; their cry sharp and shrill, and may be heard a great way off. This, as well as the other species, is called by the French *chirurgien*. The flesh is accounted pretty good. The parra variabilis, or spur-winged water hen, is about nine inches long. The bill is about 14 inches in length, and in colour is orange yellow. On the forehead is a flap of red skin; the crown of the head is brown, marked with spots of a darker colour; the hind part of the neck is much the same, but of a deeper dye. The sides of the head, throat, fore part of the neck, breast, belly, thighs, and under tail coverts are white, with a very few red spots on the sides of the belly and base of the thighs. On the fore part of the wing is a yellow spur, &c. The legs are furnished with long toes, as in all the others, the colour of which is bluish ash. Mr Latham says that one which came under his inspection from Cayenne was rather smaller. It had the upper parts much paler; over the eye was a streak of white passing no further, and unaccompanied by a black one. The hind part of the neck was dusky black. It had only the rudiment of a spur; and the red caruncle on the forehead was less, and laid back on the forehead. From these differences this learned ornithologist conceives it to have differed either in sex or age from the other. This species inhabits Brasil, and is said to be pretty common about Carthagena and in South America. The parra chavaria is, as we have already observed, about the size of a dunghill cock, and stands a foot and a half from the ground. The bill is of a dirty white colour; the upper mandible similar to that in a dunghill cock; the nostrils are oblong, pervious: on both sides, at the base of the bill, is a red membrane, which extends to the temples. The irides are brown. On the hind head are about 12 blackish feathers, three inches in length, forming a crest and hanging downwards. The rest of the neck is covered with a thick black down. The body is brown, and the wings and tail inclined to black. On the bend of the wing are two or three spurs half an inch long. The belly is a light black. The thighs are half bare of feathers. The legs are very long, and of a yellow red colour. The toes are so long as to entangle one another in walking.

*Latham's Synopsis.* "This species inhabits the lakes, &c. near the river Cinu, about 30 leagues from Carthagena, in South America, and is said to feed on vegetables. Its gait is solemn and slow; but it flies easily aad swiftly. It cannot run, unless assisted by the wings at the same time. When any part of the skin is touched by the hand a crackling is felt, though it is very downy beneath the feathers; and indeed this down adheres so closely as to enable the bird at times to swim. The voice is clear and loud, but far from agreeable. The natives, who keep poultry in great numbers have one of these tame, which goes along with the flock about the neighbourhood to feed during the day, when this faithful shepherd defends them against birds of prey, being able, by means of the spurs on the wings, to drive off birds as big as the carrion vulture, and even that bird itself. It is so far of the greatest use, as it never deserts the charge committed to its care, bringing them all home safe at night. It is so tame as to suffer itself to be handled by a grown person; but will not permit children to attempt the same.—For the above account we are indebted to Linnæus, who seems to be the only one who has given any account of this wonderful bird." See *Lathan's Synopsis*.

Parrels || Parrhasius.

PARRELS, in a ship, are frames made of trucks, ribs, and ropes, which having both their ends fastened to the yards, are so contrived as to go round about the masts, that the yards by their means may go up and down upon the mast. These also, with the breast ropes, fasten the yards to the masts.

PARRET, or PEDRED river, has its rise in the southern part of Somersetshire in England. Near Langport it is joined by the Ordred, augmented by the Evel; and about four miles from this junction, it is joned by the Tone or Thone a pretty lage river, rising among the hills in the western parts of this county. About two miles below the junction of the Tone, the Parret receives another considerable stream; and thus augmented, it passes by the town of Bridgewater, and falls into the Bristol channel in Bridgewater bay.

PARRHASIUS, a famous ancient painter of Ephesus, or, as some say, of Athens: he flourished about the time of Socrates, according to Xenophon, who hath introduced him into a dialogue discoursing with that philosopher. He was one of the best painters in his time. Pliny says, that it was he who first gave symmetry and just proportions in that art; that he was likewise the first who knew how to express the truth and life of characters, and the different airs of the face; that he discovered a beautiful disposition of the hair and heightened the grace of the visage. It is allowed even by the masters in the art, that he far outshone them in the glory of succeeding in the outlines, in which consists the grand secret of painting. But it is also remarked by Pliny, that Parrhasius became insupportable with pride; and was so very vain as to give himself the most flattering epithets; such as, the tenderest, the softest, the grandest, the most delicate, and the perfecter of his art. He boasted that he was sprung from Apollo, and that he was born to paint the gods; that he had actually drawn Hercules touch by touch: that hero having often appeared to him in dreams. When the plurality of voices was against him at Samos in favour of Timanthes, in the opinion of a picture of Ajax provoked against the Greeks, for adjudging to Ulysses the arms of Achilles, he answered a person who condoled him on his check, "For my part I don't trouble myself at the sentence; but I am sorry that the son of Telamon, hath received a greater outrage than that which was formerly put upon him so unjustly." Ælian relates this story, and tell us that Parrhasius affected to wear a crown of gold upon his head, and to carry in his hand a batoon, studded with nails of the same metal. He worked at his art with pleasantry, often indeed singing. He was very licentious and loose in his pictures; and he is said, by way of amusement, to have represented the

 most

most infamous objects. His Atalantis, with her spouse Meleager, was of this kind. This piece was afterwards devised as a legacy to the emperor Tiberius, upon condition that, if he was displeased with the subject, he should receive a million sesterces instead of it. The emperor, covetous as he was, not only preferred the picture to that sum, but even placed it in his most favourite apartment. It is also said, that, though Parrhasius was excelled by Timanthes, yet he excelled Zeuxis. Among his pictures is a celebrated one of Theseus; and another representing Meleager, Hercules, and Perseus in a group together; as also Æneas, with Castor and Pollux, in a third.

Parrhasius (Janus), a famous grammarian in Italy, who was born at Cosenza in the kingdom of Naples, 1470. He was intended for the law, the profession of his ancestors; but he refused it, and cultivated classical learning. His real name was Johannes Paulus Parisius; but according to the humour of the grammarians of the age, he took instead of it Parrhasius. He taught at Milan with much reputation, being admired for a graceful delivery, in which he chiefly excelled other professors.—It was this charm in his voice, which brought a vast concourse of people to his lectures; and among others he had the pleasure to see General Trimoles, who was then threescore years old. He went to Rome when Alexander VI. was pope; and was like to be involved in the misfortunes of Bernardini Cajetan and Silius Savello, with whom he had some correspondence; but he escaped the danger, by the information of Thomas Phœdrus, professor of rhetoric, and canon of St John Lateran, whose advice he followed in retiring from Rome. Soon after, he was appointed public professor of rhetoric at Milan; but the liberty he took to censure the teachers there as arrant blockheads, provoked them in return to asperse his morals. They said he had a criminal converse with his scholars: which being a crime extremely abhorred by the Milanese, our professor was obliged to leave Milan. He went to Vicenza, where he obtained a larger salary; and he held this professorship till the states of the Venetians were laid waste by the troops of the League: upon which he went to his native country, having made his escape through the army of the enemies. He was at Cosenza, when his old friend Phœdrus persuaded Julius to send for him to Rome; and, though that design proved abortive by the death of the pope, yet, by the recommendation of John Lascaris, he was called thither under his successor Leo. X. Leo was before favourably inclined to him; and on his arrival at Rome, appointed him professor of polite literature. He had been now some time married to a daughter of Demetrius Chalcondylas; and he took with him to Rome Basil Chalcondylas, his wife's brother, and brother of Demetrius Chalcondylas, professor of the Greek tongue at Milan. He did not long enjoy this employ conferred upon him by the pope; for, worn out by his studies and labours, he became so afflicted with the gout, that for some years he had no part of his body free, except his tongue: having almost lost the use of both his legs and both his arms. He laboured besides under so great a degree of poverty, as put him out of all hopes of being ever in a better situation; so that he left Rome, and returned into Calabria, his native country, where he was tormented a long while with a fever, and at last died in the greatest misery. He left his library to his friend Seripandus, brother to Cardinal Jerome Seripandus, who built him a tomb in the convent of the Austin friars at Naples. There are several books ascribed to him; and in the dedication of one of them, his character is drawn to great advantage by Henry Stephens.



PARRHESIA. See Oratory, N° 88.

PARRICIDE, the murder of one's parents or children. By the Roman law, it was punished in a much severer manner than any other kind of homicide. After being scourged, the delinquents were sewed up in a leathern sack, with a live dog, a cock, a viper, and an ape, and so cast into the sea. Solon, it is true, in his laws, made none against parricide; apprehending it impossible that one should be guilty of so unnatural a barbarity. And the Persians, according to Herodotus, entertained the same notion, when they adjudged all persons who killed their reputed parents to be bastards. And upon some such reason as this must we account for the omission of an exemplary punishment for this crime in our English laws; which treat it no otherwise than as simple murder, unless the child was also the servant of the parent.

For though the breach of natural relation is unobserved, yet the breach of civil or ecclesiastic connexions, when coupled with murder, denominates it a new offence; no less than a species of treason, called *parva proditio*, or *petit treason;* which, however, is nothing else but an aggravated degree of murder; although, on account of the violation of private allegiance, it is stigmatized as an inferior species of treason. And thus, in the ancient Gothic constitution, we find the breach both of natural and civil relations ranked in the same class with crimes against the state and sovereign.

PARROT, in ornithology. See Psittacus.

PARSHORE, a town of England in Worcestershire, seven miles from Worcester, and 102 from London, is a neat old town on the north side of the Avon, near its junction with the river Bow, being a considerable thoroughfare in the lower road from Worcester to London. A religious house was founded here in 604, a small part of which now remains, and is used as the parish church of Holy Cross, the whole of which contained above 10 acres. The abbey church was 250 feet long, and 120 broad. The parish of Parshore is of great extent, and hath within its limits many manors and chapelries. At present it has two parishes, Holy Cross and St Andrew. In Holy Cross church are several very antique monuments. Its chief manufacture is stockings. It contains about 300 houses, and has markets on Tuesday and Saturday; fairs Easter-Tuesday, June 26th, and Tuesday before November 1st.

PARSLEY, in botany. See Apium.

PARSNEP, in botany. See Pastinaca.

PARSON *and* Vicar. A parson, *persona ecclesiæ*, is one that hath full possession of all the rights of a parochial church. He is called parson, *persona*, because by his person the church, which is an invisible body, is represented; and he is in himself a body corporate, in order to protect and defend the rights of the church (which he personates) by a perpetual succession. *Blackst. Comment.*

Parſon.

ceſſion. He is ſometimes called the *rector* or *governor* of the church; but the appellation of *parſon* (however it may be depreciated by familiar, clowniſh, and indiſcriminate uſe) is the moſt legal, moſt beneficial, and moſt honourable title that a pariſh prieſt can enjoy; becauſe ſuch a one (Sir Edward Coke obſerves), and he only, is ſaid *vicem ſeu perſonam eccleſiæ gerere*. A parſon has, during his life, the freehold in himſelf of the parſonage houſe, the glebe, the tithes, and other dues. But theſe are ſometimes *appropriated*; that is to ſay, the benefice is perpetually annexed to ſome ſpiritual corporation, either ſole or aggregate, being the patron of the living; whom the law eſteems equally capable of providing for the ſervice of the church as any ſingle private clergyman †.

† See *Appropriation*.

The appropriating corporations, or religious houſes, were wont to depute one of their own body to perform divine ſervice, and adminiſter the ſacraments, in thoſe pariſhes of which the ſociety was thus the parſon. This officiating miniſter was in reality no more than a curate, deputy, or vicegerent of the appropriator, and therefore called *vicarius*, or "vicar." His ſtipend was at the diſcretion of the appropriator, who was, however, bound of common right to find ſomebody, *qui illi de temporalibus, epiſcopo de ſpiritualibus, debeat reſpondere*. But this was done in ſo ſcandalous a manner, and the pariſhes ſuffered ſo much by the neglect of the appropriators, that the legiſlature was forced to interpoſe: and accordingly it is enacted, by ſtatute 15 Rich. II. c. 6. that in all appropriations of churches the dioceſan biſhop ſhall ordain (in proportion to the value of the church) a competent ſum to be diſtributed among the poor pariſhioners annually; and that the vicarage ſhall be ſufficiently endowed. It ſeems the pariſh were frequently ſufferers, not only by the want of divine ſervice, but alſo by withholding thoſe alms for which, among other purpoſes, the payment of tithes was originally impoſed: and therefore in this act a penſion is directed to be diſtributed among the poor parochians, as well as a ſufficient ſtipend to the vicar. But he, being liable to be removed at the pleaſure of the appropriator, was not likely to inſiſt too rigidly on the legal ſufficiency of the ſtipend; and therefore, by ſtatute 4 Hen. IV. c. 12. it is ordained, that the vicar ſhall be a ſecular perſon, not a member of any religious houſe; that he ſhall be vicar perpetual, not removeable at the caprice of the monaſtery; and that he ſhould be canonically inſtituted and inducted, and be ſufficiently endowed, at the diſcretion of the ordinary; for theſe three expreſs purpoſes, to do divine ſervice, to inform the people, and to keep hoſpitality. The endowments, in conſequence of theſe ſtatutes, have uſually been by a portion of the glebe or land belonging to the parſonage, and a particular ſhare of the tithes, which the appropriators found it moſt troubleſome to collect, and which are therefore generally called *petty* or *ſmall tithes*; the greater, or perdial tithes, being ſtill reſerved to their own uſe. But one and the ſame rule was not obſerved in the endowment of all vicarages. Hence ſome are more liberally, and ſome more ſcantily, endowed: and hence the tithes of many things, as wood in particular, are in ſome pariſhes rectorial, and in ſome vicarial tithes.

The diſtinction therefore of a parſon and vicar is this: The parſon has for the moſt part the whole right to all the eccleſiaſtical dues in his pariſh; but a vicar has generally an appropriator over him, entitled to the beſt part of the profits, to whom he is in effect perpetual curate, with a ſtanding ſalary. Though in ſome places the vicarage has been conſiderably augmented by a large ſhare of the great tithes; which augmentations were greatly aſſiſted by the ſtatute 27 Car. II. c. 8. enacted in favour of poor vicars and curates, which rendered ſuch temporary augmentations (when made by the appropriators) perpetual.

Parſon.

The method of becoming a parſon or vicar is much the ſame. To both there are four requiſites neceſſary; holy orders, preſentation, inſtitution, and induction. The method of conferring the holy orders of deacon and prieſt, according to the liturgy and canons, is foreign to the preſent purpoſe; any farther than as they are neceſſary requiſites to make a complete parſon or vicar. By common law, a deacon, of any age, might be inſtituted and inducted to a parſonage or vicarage; but it was ordained, by ſtatute 13 Eliz. c. 12. that no perſon under twenty-three years of age, and in deacon's orders, ſhould be preſented to any benefice with cure; and if he were not ordained prieſt within one year after his induction, he ſhould be *ipſo facto* deprived: and now, by ſtatute 13 and 14 Car. II. c. 4. no perſon is capable to be admitted to any benefice, unleſs he hath been firſt ordained a prieſt; and then he is, in the language of the law, a clerk in orders. But if he obtains orders, or a licenſe to preach, by money or corrupt practices, (which ſeems to be the true, though not the common, notion of ſimony), the perſon giving ſuch orders forfeits 40l. and the perſon receiving, 10l. and is incapable of any eccleſiaſtical preferment for ſeven years after.

Any clerk may be preſented to a parſonage or vicarage; that is, the patron, to whom the advowſon of the church belongs, may offer his clerk to the biſhop of the dioceſe to be inſtituted. But when he is preſented, the biſhop may refuſe him upon many accounts. As, 1. If the patron is excommunicated, and remains in contempt 40 days; or, 2. If the clerk be unfit: which unfitneſs is of ſeveral kinds. Firſt, With regard to his perſon; as if he be a baſtard, an outlaw, an excommunicate, an alien, under age, or the like. Next, With regard to his faith or morals; as for any particular hereſy, or vice that is *malum in ſe*; but if the biſhop alleges only in generals, as that he is *ſchiſmaticus inveteratus*, or objects a fault that is *malum prohibitum* merely, as haunting taverns, playing at unlawful games, or the like, it is not good cauſe of refuſal. Or, laſtly, The clerk may be unfit to diſcharge the paſtoral office for want of learning. In any of which caſes, the biſhop may refuſe the clerk. In caſe the refuſal is for hereſy, ſchiſm, inability of learning, or other matter of eccleſiaſtical cognizance, there the biſhop muſt give notice to the patron of ſuch his cauſe of refuſal, who being uſually a layman, is not ſuppoſed to have knowledge of it; elſe he cannot preſent by lapſe: but if the cauſe be temporal, there he is not bound to give notice.

If an action at law be brought by the patron againſt the biſhop for refuſing his clerk, the biſhop muſt aſſign the cauſe. If the cauſe be of a temporal nature, and the fact admitted, (as, for inſtance, outlawry), the judges of the king's courts muſt determine its validity,

or whether it be sufficient cause of refusal: but if the act be denied, it must be determined by a jury. If the cause be of a spiritual nature, (as heresy, particularly alleged), the fact, if denied, shall also be determined by a jury: and if the fact be admitted or found, the court, upon consultation and advice of learned divines, shall decide its sufficiency. If the cause be want of learning, the bishop need not specify in what points the clerk is deficient, but only allege that he is deficient; for the statute 9 Edw. II. st. 1. c. 13. is express, that the examination of the fitness of a person presented to a benefice belongs to the ecclesiastical judge. But because it would be nugatory in this case to demand the reason of refusal from the ordinary, if the patron were bound to abide by his determination, who has already pronounced his clerk unfit; therefore if the bishop returns the clerk to be *minus sufficiens in literatura*, the court shall write to the metropolitan to re-examine him, and certify his qualifications; which certificate of the archbishop is final.

If the bishop hath no objections, but admits the patron's presentation, the clerk so admitted is next to be instituted by him; which is a kind of investiture of the spiritual part of the benefice; for by institution, the care of the souls of the parish is committed to the charge of the clerk. When a vicar is instituted, he (besides the usual forms) takes, if required by the bishop, an oath of perpetual residence; for the maxim of law is, that *vicarius non habet vicarium*: and as the non-residence of the appropriators was the cause of the perpetual establishment of vicarages, the law judges it very improper for them to defeat the end of their constitution, and by absence to create the very mischief which they were appointed to remedy; especially as, if any profits are to arise from putting in a curate and living at a distance from the parish, the appropriator, who is the real parson, has undoubtedly the elder title to them. When the ordinary is also the patron, and confers the living, the presentation and institution are one and the same act, and are called a *collation to a benefice*. By institution or collation the church is full, so that there can be no fresh presentation till another vacancy, at least in the case of a common patron; but the church is not full against the king till induction: nay, even if a clerk is instituted upon the king's presentation, the crown may revoke it before induction, and present another clerk. Upon institution also the clerk may enter on the parsonage house and glebe, and take the tithes; but he cannot grant or let them, or bring an action for them, till induction. See Induction.

For the rights of a parson or vicar, in his tithes and ecclesiastical dues, see Tithes. As to his duties, they are so numerous, that it is impracticable to recite them here with any tolerable conciseness or accuracy; but the reader who has occasion may consult *Bishop Gibson's Codex*, *Johnson's Clergyman's Vade Mecum*, and *Burn's Ecclesiastical Law*. We shall therefore only just mention the article of residence, upon the supposition of which the law doth style every parochial minister an incumbent. By statute 21 Henry VIII. c. 13. persons willingly absenting themselves from their benefices, for one month together, or two months in the year, incur a penalty of 5l. to the king, and 5l. to any person that will sue for the same; except chaplains to the king, or others therein mentioned, during their attendance in the household of such as retain them; and also except all heads of houses, magistrates, and professors in the universities, and all students under forty years of age residing there, *bona fide*, for study. Legal residence is not only in the parish, but also in the parsonage house; for it hath been resolved, that the statute intended residence, not only for serving the cure and for hospitality, but also for maintaining the house, that the successor also may keep hospitality there.



We have seen that there is but one way whereby one may become a parson or vicar: there are many ways by which one may cease to be so. 1. By death. 2. By cession, in taking another benefice; for by statute 21 Hen. VIII. c. 13. if any one having a benefice of 8l. *per annum*, or upwards, in the king's books, (according to the present valuation), accepts any other, the first shall be adjudged void, unless he obtains a dispensation; which no one is entitled to have but the chaplains of the king and others therein mentioned, the brethren and sons of lords and knights, and doctors and bachelors of divinity and law, admitted by the universities of this realm. And a vacancy thus made for want of a dispensation, is called *cession*. 3. By consecration; for, as was mentioned before, when a clerk is promoted to a bishopric, all his other preferments are void the instant that he is consecrated. But there is a method, by the favour of the crown, of holding such livings *in commendam*. *Commenda*, or *ecclesia commendata*, is a living commended by the crown to the care of a clerk, to hold till a proper pastor is provided for it. This may be temporary for one, two, or three years, or perpetual, being a kind of dispensation to avoid the vacancy of the living, and is called a *commenda retinere*. There is also a *commenda recipere*, which is to take a benefice *de novo* in the bishop's own gift, or the gift of some other patron consenting to the same; and this is the same to him as institution and induction are to another clerk. 4. By resignation. But this is of no avail till accepted by the ordinary, into whose hands the resignation must be made. 5. By deprivation, either by canonical censures, or in pursuance of divers penal statutes, which declare the benefice void, for some nonfeasance or neglect, or else some malefeasance or crime: as for simony; for maintaining any doctrine in derogation of the king's supremacy, or of the thirty-nine articles, or of the book of common prayer; for neglecting after institution to read the liturgy and articles in the church, or make the declarations against Popery, or take the abjuration oath; for using any other form of prayer than the liturgy of the church of England; or for absenting himself 60 days in one year from a benefice belonging to a Popish patron, to which the clerk was presented by either of the universities: in all which, and similar cases, the benefice is *ipso facto* void, without any formal sentence of deprivation.

PARSONAGE, a rectory, or parish church, endowed with a glebe, house, lands, tithes, &c. for the maintenance of a minister, with cure of souls within such parish. See Parson.

PARSONS, or Persons (Robert), an eminent writer of the church of Rome, was born at Nether-Stowey, near Bridgewater, in Somersetshire, in 1546, and educated at Baliol college, Oxford, where he distinguished himself as a zealous Protestant and an acute disputant;

disputant; but being charged by the society with incontinency and embezzling the college money, he went to Flanders, and declared himself a Catholic. After travelling to several other places, he effected the establishment of the English seminary at Rome, and procured Father Allen to be chosen rector of it. He himself was appointed the head of the mission to England, in order to dethrone Queen Elizabeth, and if possible extirpate the Protestant religion. He accordingly came over to this kingdom in 1580, and took some bold steps towards accomplishing his purpose, in which he concealed himself with great art, travelling about the country to gentlemen's houses, disguised in the habit sometimes of a soldier, sometimes of a gentleman, and at other times like a minister or an apparitor; but Father Campian being seized and committed to prison, our author escaped out of England for fear of the same fate, and went to Rome, where he was made rector of the English seminary. He had long entertained the most sanguine hopes of converting to the Popish faith the young king of Scots, which he considered as the best and most effectual means of bringing over his subjects to the same religious principles; but finding it impossible to succeed in his design, he published in 1594 his celebrated book, under the feigned name of *Doleman*, in order to overthrow, as far as lay in his power, the title of that prince to the crown of England. He died at Rome in 1610, and was buried in the chapel of the English college. Besides the book already mentioned, he wrote, 1. A Defence of the Catholic Hierarchy. 2. The Liturgy of the Sacrament of the Mass. 3. A Memorial for the Reformation: and several other tracts.

PART, a portion of some whole, considered as divided or divisible.

*Logical Part*, is a division for which we are indebted to the schoolmen. It refers to some universal as its whole; in which sense the species are parts of a genus, and individuals or singulars are parts of the species.

*Physical Part*, is that which, though it enter the composition of a whole, may yet be considered apart, and under its own distinct idea; in which sense, a continuum is said to consist of parts. Physical parts, again, are of two kinds, homogeneous and heterogeneous; the first are those of the same denomination with some other; the second of a different one: See HOMOGENEOUS, &c.) Parts, again, are distinguished into subjective, essential, and integrant. The schoolmen were also the authors of this division.

*Aliquot Part*, is a quantity which, being repeated any number of times, becomes equal to an integer. Thus 6 is an aliquot part of 24, and 5 an aliquot part of 30, &c.

*Aliquant Part*, is a quantity which, being repeated any number of times, becomes always either greater or less than the whole. Thus 5 is an aliquant part of 17, and 9 an aliquant part of 10, &c.

The aliquant part is resolvable into aliquot parts. Thus 15, an aliquant part of 20, is resolvable into $10\frac{1}{2}$, and 5 a fourth part of the same.

*Parts of Speech*, in grammar, are all the sorts of words which can enter the composition of a discourse. See GRAMMAR.



PARTERRE, in gardening, a level division of ground, which for the most part faces the south, or best front of a house, and is generally furnished with evergreens, flowers, &c. There are two kinds of these, the plain ones and the parterres of embroidery.

Plain parterres are most valuable in England, because of the firmness of the English grass turf, which is superior to that of any other part of the world; and the parterres of embroidery are cut into shell and scroll work, with alleys between them. An oblong, or long square, is accounted the most proper figure for a parterre; and a parterre should indeed be always twice as long as it is broad, because, according to the known laws of perspective, a long square always sinks to a square; and an exact square always appears less than it really is. As to the breadth of a parterre, it is to be proportionable to the front of the house; but less than 100 feet in breadth is too little.

There should be on each side the parterre a terrace walk raised for a view, and the flat of the parterre between the terraces should never be more than 300 feet, at the utmost, in breadth; and about 140 feet in width, with twice and a half that in length, is esteemed a very good size and proportion.

PARTHENIUM, in botany: A genus of the pentandria order, belonging to the monœcia class of plants; and in the natural method ranking under the 49th order, *Compositæ*. The male calyx is common and pentaphyllous; the florets of the disk monopetalous: the female has five florets of the radius, each with two male florets behind it; the intermediate female superior; the seed is naked.

It has been much neglected in Europe, having on account of its smell been banished from our parterres. It is therefore indebted for its culture to the distinguished rank it holds among the Chinese flowers. The skill of the florists, and their continual care, have brought this plant to so great perfection, that Europeans scarcely know it. The elegance and lightness of its branches, the beautiful indentation of its leaves, the splendour and duration of its flowers, seem indeed to justify the *florimania* of the Chinese for this plant. They have, by their attention to its culture, procured more than 300 species of it: every year produces a new one. A list of the names of all these kinds would be equally tedious and disgusting; we shall only say in general, that in its flowers are united all the possible combinations of shapes and colours. Its leaves are no less various: some of them are thin, other thick; some are very small, and some large and broad; some are indented like those of the oak, while others resemble those of the cherry tree; some may be seen cut in the form of fins, and others are found serrated on the margin, and tapering towards the points.

*Grosier's General Description of China.*

Parthenium is propagated in China by seed, and by suckers, grafts, and slips. When the florists have a fine plant, they suffer the seeds to ripen, and about the end of autumn sow them in well prepared earth. Some keep them in this manner during winter, others sow them in spring. Provided they are watered after the winter, they shoot forth, and grow rapidly. After the parthenium has flowered, all its branches are cut three inches from the root, the earth is hoed around, and a little dung is mixed with it; and when the cold be-

comes severe, the plant is covered with straw, or an inverted pot. Those that are in vases are transported to the greenhouse, where they are not watered. In spring they are uncovered and watered, and they shoot forth a number of stems: of these some florists leave only two or three, others pull up the stalks together with the whole root, and divide it into several portions, which they transplant elsewhere. There are some who join two slips of different colours, in each of which, towards the bottom, they make the long notch, almost to the pith, and afterwards tie them together with packthread, that they may remain closely united: by these means they obtain beautiful flowers, variegated with whatever colours they choose.

Parthenium requires a good exposure, and fresh moist air that circulates freely: when shut up closely by four walls, it soon languishes. The earth in which it is planted ought to be rich, moist, and loamy, and prepared with great care. For refreshing it, the Chinese use only rain or river water; and in spring time, they mix with this water the excrements of silk worms or the dung of their poultry; in summer, they leave the feathers of ducks or fowls to infuse in it for several days, after having thrown into it a little saltpetre; but in autumn they mix with the water a greater or smaller quantity of dried excrement reduced to powder, according as the plant appears more or less vigorous. During the great heats of summer, they water it morning and evening; but they moisten the leaves only in the morning: they also place small fragments of brick round its roots, to prevent the water from pressing down the earth too much. All this attention may appear trifling; but it is certain that it is founded upon experience and observation, and it is only by the assistance of such minute care, that the patient and provident Chinese has been able to procure, from a wild and almost stinking plant, so beautiful and odoriferous flowers. The more common species are, 1. Hysterophorus. 2. Integrifolium.

PARTHIA, a celebrated empire of antiquity, bounded on the west by Media, on the north by Hyrcania, on the east by Aria, on the south by Carmania the desert; surrounded on every side by mountains, which still serve as a boundary, though its name is now changed, having obtained that of *Eyrac* or *Arac;* and to distinguish it from Chaldæa, that of *Eyrac Agami*. By Ptolemy it is divided into five districts, *viz.* Caminsine, or Gamisene, Parthyene, Choroane, Atticene, and Tabiene. The ancient geographers enumerate a great many cities in this country. Ptolemy in particular reckons 25 large cities; and it certainly must have been very populous, since we have accounts of 2000 villages, besides a number of cities, in this district being destroyed by earthquakes. Its capital was named *Hecatompolis*, from the circumstance of its having 100 gates. It was a noble and magnificent place; and, according to some, it still remains under the name of *Ispahan*, the capital of the present Persian empire.

Ancient divisions.

2 Whence peopled.

Parthia is by some supposed to have been first peopled by the Phetri or Pathri, often mentioned in Scripture, who will have the Parthians to be descended from Pathrusim the son of Misraim. But however true this may be with regard to the ancient inhabitants, yet it is certain, that those Parthians who were so famous in history, descended from the Scythians, though from what tribe we are not certainly informed.

The history of the ancient Parthians is totally lost. All that we know about them is, that they were first subject to the Medes, afterwards to the Persians, and lastly to Alexander the Great. After his death the province fell to Seleucus Nicator, and was held by him and his successors till the reign of Antiochus Theus, about the year 250 before Christ. At this time the Parthians revolted, and chose one Arsaces for their king. The immediate cause of this revolt was the lewdness of Agathocles, to whom Antiochus had committed the care of all the provinces beyond the Euphrates. This man made an infamous attempt on Tiridates, a youth of great beauty; which so enraged his brother Arsaces, that he excited his countrymen to revolt; and before Antiochus had leisure to attend to the rebellion, it became too powerful to be crushed. Seleucus Callinicus, the successor of Antiochus Theus, attempted to reduce Arsaces; but the latter having had so much time to strengthen himself, defeated and drove his antagonist out of the country. Seleucus, however, in a short time, undertook another expedition against Arsaces; but was still more unfortunate than he had been in the former, being not only defeated in a great battle, but taken prisoner, and died in captivity. The day on which Arsaces gained this victory was ever after observed among the Parthians as an extraordinary festival. Arsaces being thus fully established in his new kingdom, reduced Hyrcania and some other provinces under his power; and was at last killed in a battle against Ariarathes IV. king of Cappadocia. From this prince all the other kings of Parthia took the surname of *Arsaces*, as those of Egypt did that of *Ptolemy* from Ptolemy Soter.

3 Cause of the Parthians revolt from Antiochus Theus.

Arsaces I. was succeeded by his son Arsaces II. who, entering Media, made himself master of that country, while Antiochus the Great was engaged in a war with Ptolemy Euergetes king of Egypt. Antiochus, however, was no sooner disengaged from that war, than he marched with all his forces against Arsaces, and at first drove him quite out of Media. But he soon returned with an army of 100,000 foot and 20,000 horse, with which he put a stop to the further progress of Antiochus; and a treaty was soon after concluded, in which it was agreed, that Arsaces should remain master of Parthia and Hyrcania, upon condition of his assisting him in his wars with other nations.

Arsaces II. was succeeded by his son Priapatius, who reigned 15 years, and left three sons, Phraates, Mithridates, and Artabanus. Phraates, the eldest, succeeded to the throne, and reduced under his subjection the Mardi, who had never been conquered by any but Alexander the Great. After him, his brother Mithridates was invested with the regal dignity. He reduced the Bactrians, Medes, Persians, Elymeans, and overran in a manner all the east, penetrating beyond the boundaries of Alexander's conquests. Demetrius Nicator, who then reigned in Syria, endeavoured to recover those provinces; but his army was entirely destroyed, and himself taken prisoner, in which state he remained till his death; after which victory Mithridates made himself master of Babylonia and Mesopotamia, so that he now commanded all the provinces from between the Euphrates and the Ganges.

Conquests of the Parthian monarchs.

Mithridates

Parthia.

Antiochus Sidetes destroyed with his whole army.

Mithridates died in the 37th year of his reign, and left the throne to his son Phrahates II. who was scarce settled in his kingdom when Antiochus Sidetes marched against him at the head of a numerous army, under pretence of delivering his brother Demetrius, who was still in captivity. Phrahates was defeated in three pitched battles; in consequence of which he lost all the countries conquered by his father, and was reduced within the limits of the ancient Parthian kingdom. Antiochus did not, however, long enjoy his good fortune; for his army, on account of their number, amounting to no fewer than 400,000, being obliged to separate to such distances as prevented them, in case of any sudden attack, from joining together, the inhabitants, whom they had most cruelly oppressed, taking advantage of this separation, conspired with the Parthians to destroy them. This was accordingly executed; and the vast army of Antiochus, with the monarch himself, were slaughtered in one day, scarce a single person escaping to carry the news to Syria. Phrahates, elated with this success, proposed to invade Syria; but in the mean time, happening to quarrel with the Scythians, he was by them cut off with his whole army, and was succeeded by his uncle Artabanus.

The new king enjoyed his dignity but a very short time, being, a few days after his accession, killed in another battle with the Scythians. He was succeeded

6 Alliance concluded with the Romans.

by Pacorus I. who entered into an alliance with the Romans; and he by Phrahates III. This monarch took under his protection Tigranes the son of Tigranes the Great, king of Armenia, gave him his daughter in marriage, and invaded the kingdom with a design to place the son on the throne of Armenia; but on the approach of Pompey he thought proper to retire, and soon after solemnly renewed the treaty with the Romans.

Phrahates was murdered by his children Mithridates and Orodes; and soon after the former was put to death by his brother, who thus became sole master of the Parthian empire. In his reign happened the memorable war with the Romans under Crassus. This

Crassus resolves on a war with the Parthians.

was occasioned not by any breach of treaty on the side of the Parthians, but through the shameful avarice of Crassus. The whole Roman empire at that time had been divided between Cæsar, Pompey, and Crassus; and by virtue of that partition, the eastern provinces had fallen to the lot of Crassus. No sooner was he invested with this dignity, than he resolved to carry the war into Parthia, in order to enrich himself with the spoils of that people, who were then looked upon to be very wealthy. Some of the tribunes opposed him, as the Parthians had religiously observed the treaty; but Crassus having, by the assistance of Pompey, carried every thing before him, left Rome in the year 55 B. C. and pursued his march to Brundusium, where he immediately embarked his troops, though the wind blew very high; and after a difficult passage, where he lost many of his ships, he reached the ports of Galatia.

8 Plunders the temple at Jerusalem.

From Galatia Crassus hastened to Syria, and passing through Judea, plundered the temple at Jerusalem in his way. He then marched with as great expedition as he could to the river Euphrates, which he crossed on a bridge of boats: and, entering the Parthian dominions, began hostilities. As the enemy had not expected an invasion, they were quite unprepared for resistance; and therefore Crassus overran all Mesopotamia; and if he had taken advantage of the consternation which the Parthians were in, might have also reduced Babylonia. But instead of this, early in the autumn, he repassed the Euphrates, leaving only 7000 foot and 1000 horse to garrison the places he had reduced; and putting his army into winter quarters in Syria, gave himself totally up to his favourite passion of amassing money.

Early in the spring, the Roman general drew his forces out of their winter quarters, in order to pursue the war with vigour; but, during the winter, Orodes had collected a very numerous army, and was well prepared to oppose him. Before he entered upon action, however, the Parthian monarch sent ambassadors to Crassus, in order to expostulate with him on his injustice in attacking an ally of the Roman empire; but Crassus, without attending to what they said, only returned for answer, that "they should have his answer at Seleucia.

Orodes, finding that a war was not to be avoided, divided his army into two bodies. One he commanded in person, and marched towards Armenia, in order to oppose the king of that country, who had raised a considerable army to assist the Romans. The other he sent into Mesopotamia, under the command of Surena or Surenas, a most experienced general, by whose conduct all the cities which Crassus had reduced were 9

His soldiers disheartened.

quickly retaken. On this some Roman soldiers who made their escape, and fled to the camp of Crassus, filled the minds of his army with terror at the accounts of the number, power, and strength, of the enemy. They told their fellow soldiers, that the Parthians were very numerous, brave, and well disciplined; that it was impossible to overtake them when they fled, or escape them when they pursued; that their defensive weapons were proof against the Roman darts, and their offensive weapons so sharp, that no buckler was proof against them, &c. Crassus looked upon all this only as the effect of cowardice: but the common soldiers, and even many of the chief officers, were so disheartened, that Cassius, the same who afterwards conspired against Cæsar, and most of the legionary tribunes, advised Crassus to suspend his march, and consider better of the enterprise before he proceeded farther in it. But Crassus obstinately persisted in his former resolution, being encouraged by the arrival of Artabazus king of Armenia, who brought with him 6000 horse, and promised to send 10,000 cuirassiers and 30,000 foot, whenever he should stand in need of them. At the same time, he advised him by no means to march his army through the plains of Mesopotamia, but to take his route over the mountains of Armenia. He told him, that as Armenia was a mountainous country, the enemy's cavalry, in which their main strength consisted, would there be entirely useless; and besides, his army would there be plentifully supplied with all manner of necessaries: whereas, if he marched by the way of Mesopotamia, he would be perpetually harassed by the Parthian horse, and frequently be obliged to lead his army through sandy deserts, where he would be distressed for want of water and all other provisions. This salutary advice, however,

Parthia. ever, was rejected, and Crassus entered Mesopotamia with an army of about 40,000 men.

The Romans had no sooner crossed the Euphrates, than Cassius advised his general to advance to some of those towns in which the garrisons yet remained, in order to halt and refresh his troops: or if he did not choose to follow this advice, he said that his best way would be to march along the banks of the Euphrates to Seleucia; as by this method he would prevent the Parthians from surrounding him, at the same time that he would be plentifully supplied with provisions from his ships. Of this advice Crassus seemed to approve; but was dissuaded by Abgarus king of Edessa, whom the Romans took for an ally, but who was in reality a traitor sent by Surenas to bring about the destruction of the Roman army.

10 Betrayed by Abgarus king of Edessa.

Under the conduct of this faithless guide, the Romans entered a vast green plain divided by many rivulets. Their march proved very easy through this fine country; but the farther they advanced, the worse the roads became, insomuch that they were at last obliged to climb up rocky mountains, which brought them to a dry and sandy plain, where they could neither find food to satisfy their hunger, nor water to quench their thirst. Abgarus then began to be suspected by the tribunes and other officers, who earnestly entreated Crassus not to follow him any longer, but to retreat to the mountains; at the same time an express arrived from Artabazus, acquainting the Roman general that Orodes had invaded his dominions with a great army, and that he was obliged to keep his troops at home, in order to defend his own dominions. The same messenger advised Crassus in his master's name to avoid by all means the barren plains, where his army would certainly perish with hunger and fatigue, and by all means to approach Armenia, that they might join their forces against the common enemy. But all was to no purpose; Crassus, instead of hearkening either to the advice of the king or his own officers, first flew into a violent passion with the messengers of Artabazus, and then told his troops, that they were not to expect the delights of Campania in the most remote parts of the world.

Thus they continued their march for some days cross a desert, the very sight of which was sufficient to throw them into the utmost despair; for they could not perceive, either near them or at a distance, the least tree, plant, or brook, not so much as a hill, or a single blade of grass; nothing was to be seen all around them but huge heaps of burning sand. The Romans had scarcely got through this desert, when word was brought them by their scouts, that a numerous army of Parthians was advancing full march to attack them; for Abgarus, under pretence of going out on parties, had often conferred with Surenas, and concerted measures with him for destroying the Roman army. Upon this advice, which occasioned great confusion in the camp, the Romans being quite exhausted and tired out with their long and troublesome march, Crassus drew up his men in battalia, following at first the advice of Cassius, who was for extending the infantry as wide as possible, that they might take up the more ground, and by that means prevent the enemy from surrounding them: but Abgarus assuring the proconsul that the Parthian forces were not so numerous as was represented, he changed this disposition, and believing only the man who betrayed him, drew up his troops in a square, which faced every way, and had on each side 12 cohorts in front. Near each cohort he placed a troop of horse to support them, that they might charge with the greater security and boldness. Thus the whole army looked more like one phalanx than troops drawn up in manipuli, with spaces between them, after the Roman manner. The general himself commanded in the centre, his son in the left wing, and Cassius in the right.

In this order they advanced to the banks of a small river called the *Balissus*, the sight of which was very pleasing to the soldiers, who were much harassed with drought and excessive heat. Most of the officers were for encamping on the banks of this river, or rather rivulet, to give the troops time to refresh themselves after the fatigues of so long and painful a march; and, in the mean time, to procure certain intelligence of the number and disposition of the Parthian army; but Crassus, suffering himself to be hurried on by the inconsiderate ardour of his son, and the horse he commanded, only allowed the legions to take a meal standing; and before this could be done by all, he ordered them to advance, not slowly, and halting now and then, after the Roman manner, but as fast as they could move, till they came in sight of the enemy, who, contrary to their expectation, did not appear either so numerous or so terrible as they had been represented; but this was a stratagem of Surenas, who had concealed his men in convenient places, ordering them to cover their arms, lest their brightness should betray them, and, starting up at the first signal, to attack the enemy on all sides. The stratagem had the desired effect; for Surenas no sooner gave the signal, than the Parthians, rising as it were out of the ground, with dreadful cries, and a most frightful noise, advanced against the Romans, who were greatly surprised and dismayed at the sight; and much more so, when the Parthians, throwing off the covering of their arms, appeared in shining cuirasses, and helmets of burnished steel, finely mounted on horses covered all over with armour of the same metal. At their head appeared young Surenas, in a rich dress, who was the first who charged the enemy, endeavouring, with his pikemen, to break through the first ranks of the Roman army; but finding it too close and impenetrable, the cohorts supporting each other, he fell back, and retired in a seeming confusion: but the Romans were much surprised when they saw themselves suddenly surrounded on all sides, and galled with continual showers of arrows. Crassus ordered his light armed foot and archers to advance, and charge the enemy; but they were soon repulsed, and forced to cover themselves behind the heavy armed foot. Then the Parthian horse, advanced near the Romans, discharged showers of arrows upon them, every one of which did execution, the legionaries being drawn up in such close order, that it was impossible for the enemy to miss their aim. As their arrows were of an extraordinary weight, and discharged with incredible force and impetuosity, nothing was proof against them. The two wings advanced in good order to repulse them, but to no effect; for the Parthians shot their arrows with as great dexterity when their backs were turned, as

11 The battle of Carrhæ.

Parthia. as when they faced the enemy; so that the Romans, whether they kept their ground, or pursued the flying enemy, were equally annoyed with their fatal arrows.

The Romans, as long as they had any hopes that the Parthians, after having spent their arrows, would either betake themselves to flight, or engage them hand to hand, stood their ground with great resolution and intrepidity; but when they observed that there were a great many camels in their rear loaded with arrows, and that those who emptied their quivers wheeled about to fill them anew, they began to lose courage, and loudly to complain of their general for suffering them thus to stand still, and serve only as a butt to the enemy's arrows, which, they well saw, would not be exhausted till they were all killed to a man. Hereupon Crassus ordered his son to advance, at all adventures, and attack the enemy with 1300 horse, 500 archers, and 8 cohorts. But the Parthians no sooner saw this choice body (for it was the flower of the army) marching up against them, than they wheeled about, and betook themselves, according to their custom, to flight. Hereupon young Crassus, crying out as loud as he could, *They fly before us*, pushed on full speed after them, not doubting but he should gain a complete victory; but when he was at a great distance from the main body of the Roman army, he perceived his mistake; for those who before had fled, facing about, charged him with incredible fury. Young Crassus ordered his troops to halt, hoping that the enemy, upon seeing their small number, would not be afraid to come to a close fight: but herein he was likewise greatly disappointed; for the Parthians, contenting themselves to oppose his front with their heavy armed horse, surrounded him on all sides; and, keeping at a distance, discharged incessant showers of arrows upon the unfortunate Romans, thus surrounded and pent up. The Parthian cavalry, in wheeling about, raised so thick a dust, that the Romans could scarce see one another, much less the enemy: nevertheless, they found themselves wounded with arrows, though they could not perceive whence they came. In a short time the place where they stood was all strown with dead bodies.

12 Extreme distress of the Romans.

Some of the unhappy Romans finding their entrails torn, and many overcome by the exquisite torments they suffered, rolled themselves in the sand with the arrows in their bodies, and expired in that manner. Others endeavouring to tear out by force the bearded points of the arrows, only made the wounds the larger and increased their pain. Most of them died in this manner; and those who outlived their companions were no more in a condition to act; for when young Crassus exhorted them to march up to the enemy, some showed him their wounded bodies, others their hands nailed to their bucklers, and some their feet pierced through and pinned to the ground; so that it was equally impossible for them either to attack the enemy or defend themselves. The young commander, therefore, leaving his infantry to the mercy of the enemy, advanced at the head of the cavalry against their heavy armed horse. The thousand Gauls whom he had brought with him from the west, charged the enemy with incredible boldness and vigour; but their lances did little execution on men armed with cuirasses, and horses covered with tried armour: however, they behaved with great resolution; for some of them taking hold of the enemy's spears, and closing with them, threw them off their horses on the ground, where they lay without being able to stir, by reason of the great weight of their armour; others, dismounting, crept under the enemy's horses, and thrusting their swords into their bellies, made them throw their riders. Thus the brave Gauls fought, though greatly harassed with heat and thirst, which they were not accustomed to bear, till most of their horses were killed, and their commander dangerously wounded. They then thought it advisable to retire to their infantry, which they no sooner joined, than the Parthians invested them anew, making a most dreadful havock of them with their arrows. In this desperate condition, Crassus, spying a rising ground at a small distance, led the remains of his detachment thither, with a design to defend himself in the best manner he could, till succours should be sent him from his father. The Parthians pursued him; and having surrounded him in his new post, continued showering arrows upon his men, till most of them were either killed or disabled, without being able to make use of their arms, or give the enemy proofs of their valour.

Young Crassus had two Greeks with him, who had settled in the city of Carrhæ. These, touched with compassion, at seeing so brave a man reduced to such straits, pressed him to retire with them to the neighbouring city of Ischnes, which had declared for the Romans; but the young Roman rejected their proposal with indignation, telling them, that he would rather die a thousand times than abandon so many valiant men, who sacrificed their lives for his sake. Having returned this answer to his two Greek friends, he embraced and dismissed them, giving them leave to retire and shift for themselves in the best manner they could. As for himself, having now lost all hopes of being relieved, and seeing most of his men and friends killed round him, he gave way to his grief; and, not 13 The death of young Crassus.
being able to make use of his arm, which was shot through with a large barbed arrow, he presented his side to one of his attendants, and ordered him to put an end to his unhappy life. His example was followed by Censorius a senator, by Megabacchus an experienced and brave officer, and by most of the nobility who served under him. Five hundred common soldiers were taken prisoners, and the rest cut in pieces.

The Parthians, having thus cut off or taken the whole detachment commanded by young Crassus, marched without delay against his father who, upon the first advice that the enemy fled before his son, and were closely pursued by him, had taken heart, the more because those who had remained to make head against him seemed to abate much of their ardour, the greatest part of them having marched with the rest against his son. Wherefore, having encouraged his troops, he had retired to a small hill in his rear, to wait there till his son returned from the pursuit. Young Crassus had despatched frequent expresses to his father, to acquaint him with the danger he was in; but they had fallen into the enemy's hands, and been by them put to the sword: only the last, who had escaped with great difficulty, arrived safe, and inform-

 ed

ed him that his son was lost if he did not send him an immediate and powerful reinforcement. This news threw Crassus into the utmost consternation; a thousand affecting thoughts rose in his mind, and disturbed his reason to such a degree, that he scarce knew what he was doing. However, the desire he had of saving his son, and so many brave Romans who were under his command, made him immediately decamp, and march to their assistance; but he was not gone far before he was met by the Parthians, who, with loud shouts, and songs of victory, gave, at a distance, the unhappy father notice of his misfortune. They had cut off young Crassus's head, and, having fixed it on the point of a lance, were advancing full speed to fall on the father. As they drew near, Crassus was struck with that dismal and affecting sight; but, on this occasion, behaved like a hero: for though he was under the deepest concern, he had the presence of mind to stifle his grief, for fear of discouraging the army, and to cry out to the dismayed troops, "This misfortune is entirely mine; the loss of one man cannot affect the victory: Let us charge, let us fight like Romans: if you have any compassion for a father who has just now lost a son whose valour you admired, let it appear in your rage and resentment against these insulting barbarians." Thus Crassus strove to reanimate his troops; but his efforts were unsuccessful: their courage was quite sunk, as appeared from the faint and languishing shout which they raised, according to custom, before the action. When the signal was given, the Parthians, keeping to their old way of fighting, discharged clouds of arrows on the legionaries, without drawing near them; which did such dreadful execution, that many of the Romans, to avoid the arrows, which occasioned a long and painful death, threw themselves, like men in despair, on the enemy's heavy-armed horse, seeking from their spears a more quick and easy kind of death. Thus the Parthians continued plying them incessantly with their arrows till night, when they left the field of battle, crying out, that they would allow the father one night to lament the death of his son.

14 Distress of Crassus.

This was a melancholy night for the Romans. Crassus kept himself concealed from the soldiery, lying not in the general's tent, but in the open air, and on the bare ground, with his head wrapped up in his paludamentum or military cloak: and was, in that forlorn condition, says Plutarch, a great example to the vulgar, of the instability of fortune; to the wise, a still greater of the pernicious effects of avarice, temerity, and ambition. Octavius, one of his lieutenants, and Cassius, approached him, and endeavoured to raise him up and console him: but, seeing him quite sunk under the weight of his affliction, and deaf to all comfort, they summoned a council of war, composed of all the chief officers; wherein it was unanimously resolved, that they should decamp before break of day, and retire, without sound of trumpet, to the neighbouring city of Carrhæ, which was held by a Roman garrison. Agreeable to this resolution, they began their march as soon as the council broke up; which produced dreadful outcries among the sick and wounded, who, perceiving that they were to be abandoned to the mercy of the enemy, filled the camp with their complaints and lamentations: but their cries and tears, though very affecting, did not stop the march of the others, which, indeed, was very slow, to give the stragglers time to come up. There were only 300 light horse, under the command of one Ægnatius, who pursued their march without stopping. These arriving at Carrhæ about midnight, Ægnatius, calling to the centinels on the walls, desired them to acquaint Coponius, governor of the place, that Crassus had fought a great battle with the Parthians; and, without saying a word more, or letting them know who he was, continued his march with all possible expedition to the bridge of Zeugma; which he passed, and by that means saved his troops, but was much blamed for abandoning his general.

However, the message he sent to Coponius was of some temporary service to Crassus. For that commander, wisely conjecturing, from the manner in which the unknown person had given him that intelligence, that some misfortune had befalled Crassus, immediately ordered his garrison to stand to their arms; and, marching out, met Crassus, and conducted him and his army into the city: for the Parthians, though informed of his flight, did not offer to pursue him, observing therein the superstitious custom which obtained among them and the Persians, not to fight in the night; but when it was day, they entered the Roman camp, and having put all the wounded, to the number of 4000, to the sword, dispersed their cavalry all over the plain, in pursuit of the fugitives. One of Crassus's lieutenants, named *Varguntеius*, having separated in the night from the main body of the army, with four cohorts, missed his way, and was overtaken by the enemy; at whose approach he withdrew to a neighbouring hill, where he defended himself, with great valour, till all his men were killed, except 20, who made their way through the enemy sword in hand, and got safe to Carrhæ: but Vargunteius himself lost his life on this occasion.

In the mean time Surenas, not knowing whether Crassus and Cassius had retired to Carrhæ, or chosen a different route; in order to be informed of the truth, and take his measures accordingly, despatched a messenger, who spoke the Roman language, to the city of Carrhæ, enjoining him to approach the walls, and acquaint Crassus himself, or Cassius, that the Parthian general was inclined to enter into a treaty with them, and demanded a conference. Both the proconsul and his quæstor Cassius spoke from the walls with the messenger; and, accepting the proposal with great joy, desired that the time and place for an interview might be immediately agreed upon. The messenger withdrew, promising to return quickly with an answer from Surenas: but that general no sooner understood that Crassus and Cassius were in Carrhæ, than he marched thither with his whole army; and, having invested the place, acquainted the Romans, that if they expected any favourable terms, they must deliver up Crassus and Cassius to him in chains. Hereupon a council of the chief officers being summoned, it was thought expedient to retire from Carrhæ that very night, and seek for another asylum. It was of the utmost importance that none of the inhabitants of Carrhæ should be acquainted with their design till the time of its execution; but Crassus, whose whole conduct evidently shows that he was blinded, as Dio Cassius observes, by

15 Surenas pretends to confer with Crassus.

 by some divinity, imparted the whole matter in confidence to one Andromachus, choosing him for his guide, and relying injudiciously on the fidelity of a man whom he scarce knew. Andromachus immediately acquainted Surenas with the design of the Romans; promising at the same time, as the Parthians did not engage in the night, to manage matters so, that they should not get out of his reach before daybreak. Pursuant to his promise, he led them through many windings and turnings, till he brought them into deep marshy grounds, where the infantry were up to the knees in mire. Then Cassius, suspecting that their guide had led them into those bogs with no good design, refused to follow him any longer; and returning to Carrhæ, took his route towards Syria, which he reached with 500 horse. Octavius, with 5000 men under his command, being conducted by trusty guides, gained the mountains called by Plutarch and Appian *Sinnaci*, and there intrenched himself before break of day.

As for Crassus, he was still entangled in the marshes, when Surenas, at the rising of the sun, overtook him, and invested him with his cavalry. The proconsul had with him four cohorts, and a small body of horse; and with these he gained, in spite of all opposition, the summit of another hill within 12 furlongs of Octavius; who seeing the danger that threatened his general, flew to his assistance, first with a small number of his men, but was soon followed by all the rest, who, being ashamed of their cowardice, quitted their post, tho' very safe, and, charging the Parthians with great fury, disengaged Crassus, and obliged the enemy to abandon the hill. Upon the retreat of the enemy, they formed themselves into a hollow square; and placing Crassus in the middle, made a kind of rampart round him with their bucklers, resolutely protesting, that none of the enemy's arrows should touch their general's body, till they were all killed fighting in his defence. Surenas, loth to let so fine a prey escape, surrounded the hill, as if he designed to make a new attack: but, finding his Parthians very backward, and not doubting but the Romans, when night came on, would pursue their march, and get out of his reach, he had recourse again to artifice; and declared before some prisoners, whom he soon after set at liberty, that he was inclined to treat with the proconsul of a peace; and that it was better to come to a reconciliation with Rome, than to sow the seeds of an eternal war, by shedding the blood of one of her generals.

Agreeable to this declaration, Surenas, as soon as the prisoners were released, advanced towards the hill where the Romans were posted, attended only by some of his officers, and, with his bow unbent, and open arms, invited Crassus to an interview. So sudden a change seemed very suspicious to the proconsul; who therefore declined the interview, till he was forced, by his own soldiers, to intrust his life with an enemy whose treachery they had all experienced; for the legionaries flocking round him, not only abused him in an outrageous manner, but even menaced him if he did not accept of the proposals made him by the Parthian general. Seeing, therefore, that his troops were ready to mutiny, he began to advance, without arms or guards, towards the enemy, after having called the gods and his officers to witness the violence his troops offered him; and entreated all who were present, but especially Octavius and Petronius, two of the chief commanders, for the honour of Rome their common mother, not to mention, after his death, the shameful behaviour of the Roman legionaries. Octavius and Petronius could not resolve to let him go alone; but attended him down the hill, as did likewise some legionaries, keeping at a distance. Crassus was met at the foot of the hill by two Greeks who, dismounting from their horses, saluted him with great respect: and desired him in the Greek tongue, to send some of his attendants, who might satisfy him that Surenas, and those who were with him, came without arms. Hereupon Crassus sent two brothers, of the Roscian family; but Surenas having caused them to be seized, advanced to the foot of the hill, mounted on a fine horse, and attended by the chief officers of his army. Crassus, who waited for the return of his two messengers, was surprised to see himself prevented by Surenas in person, when he least expected it. The Parthian general, perceiving, as he approached Crassus, that he was on foot, cried out, in a seeming surprise, "What do I see? a Roman general on foot, and we on horseback! Let a horse be brought for him immediately." "You need not be surprised (replied Crassus): we are come only to an interview, each after the custom of his country." "Very well (answered Surenas), there shall be henceforth a lasting peace between King Orodes and the people of Rome: but we must sign the articles of it on the banks of the Euphrates; for you Romans do not always remember your conventions." Crassus would have sent for a horse: but a very stately one with a golden bit, and richly caparisoned, was brought to him by a Parthian; which Surenas presenting to him, "Accept this horse from my hands (said he), which I give you in the name of my master King Orodes." He had scarce uttered these words, when some of the king's officers, taking Crassus by the middle, set him upon the horse, which they began to whip with great violence before them in order to make him quicken his pace. Octavius, offended at this insult, took the horse by the bridle; Petronius and the few Romans who were present, seconded him, and flocking all round Crassus, stopped his horse. The Parthians endeavoured to repulse them, and clear the way for the proconsul; whereupon they began to justle and push one another with great tumult and disorder. At last, Octavius, drawing his sword, killed one of the king's grooms; but, at the same time, another coming behind Octavius, with one blow laid him dead at his feet. Both parties fought with great resolution, the Parthians striving to carry off Crassus, and the Romans to rescue him out of their hands. In this scuffle most of the Romans who came to the conference were killed; and, among the rest, Crassus himself, but whether by a Roman or a Parthian is uncertain. 16 C killed

Upon his death, the rest of the army either surrendered to the enemy, or, dispersing in the night, were pursued, and put to the sword. The Romans lost in this campaign at least 30,000 men; of which 20,000 were killed, and 10,000 taken prisoners.

When the battle of Carrhæ was fought, King Orodes was in Armenia, where he had made peace with Arta-

bazus.

Parthia. batus. While the two kings were solemnizing their new alliance with expensive and public feasts, Styllaces or Syllaces, a Parthian officer, whom Surenas had sent with the news of his late victory, and the head of Crassus as a proof of it, arrived in the capital of Armenia. The transports of joy which Orodes felt at this sight, and these news, are not to be expressed; and the lords of both kingdoms, who attended their sovereigns, raised loud and repeated shouts of joy. Syllaces was ordered to give a more particular and distinct account of that memorable action; which when he had done, Orodes commanded melted gold to be poured into Crassus's mouth; reproaching him thereby with avarice, which had been always his predominant passion.

17 Surenas put to death by Orodes.

Surenas did not long enjoy the pleasure of his victory; for Orodes, jealous of his power and authority among the Parthians, soon after caused him to be put to death. Pacorus, the king's favourite son was put at the head of the army; and agreeably to his father's directions, invaded Syria: but he was driven out from thence with great loss by Cicero and Cassius, the only general who survived the defeat of Crassus. After this we find no mention of the Parthians, till the time of the civil war between Cæsar and Pompey, when the latter sent ambassadors to solicit succour against his rival. This Orodes was willing to grant upon condition that Syria was delivered up to him; but as Pompey would not consent to such a proposal, the succours were not only denied, but, after the battle of Pharsalia, he put Lucius Hirtius in irons, whom Pompey had again sent to ask assistance, or at least to desire leave to shelter himself in the Parthian dominions.

Cæsar is said to have meditated a war against the Parthians, which in all probability would have proved fatal to them. His death delivered them from this danger. But, not long after, the eastern provinces, being grievously oppressed by Mark Antony, rose up in arms; and having killed the tax-gatherers, invited the Parthians to join them and drive out the Romans. They very readily accepted the invitation, and crossed the Euphrates with a powerful army under the command of Pacorus, and Labienus a Roman general of Pompey's party. At first they met with great success, overran all Asia Minor, and reduced all the countries as far as the Hellespont and the Egæan sea, subduing likewise Phœnicia, Syria, and even Judea. They did not however long enjoy their new conquests: for being elated with their victories, and despising the enemy, they engaged Ventidius, Antony's lieutenant, before Labienus had time to join them, and were utterly defeated. This so disheartened Labienus's army, that they all abandoned him; and he himself, being thus obliged to wander from place to place in disguise, was at last taken and put to death at Cyprus. Ventidius pursuing his advantage, gained several other victories; and at last entirely defeated the Parthian army under Pacorus, cutting almost the whole of them in pieces, and the prince himself among the rest. He did not, however, pursue this last victory as he might have done; being afraid of giving umbrage to Antony, who had already become jealous of the great honour gained by his lieutenant. He therefore contented himself with reducing those places in Syria and Phœnicia which the Parthians had taken in the beginning of the war, until Antony arrived to take the command of the army upon himself.

18 War commenced against the Parthians by Mark Antony.

19 Pacorus defeated and killed by Ventidius.

Orodes was almost distracted with grief on receiving the dreadful news of the loss of his army and the death of his favourite son. However, when time had restored the use of his faculties, he appointed Phrahates, the eldest but the most wicked, of all his children, to succeed him in the kingdom, admitting him at the same time to a share of the sovereign authority with himself. The consequence of this was, that Phrahates very soon attempted to poison his father with hemlock. But this contrary to expectation, proving a cure for the dropsy, which an excess of grief had brought upon the king, the unnatural son had him stifled in bed, and soon after not only murdered all his own brethren, who were thirty in number, but cut off all the rest of the royal family, not sparing even his own eldest son, lest the discontented Parthians should place him, as he was already of age, on the throne.

20 Orodes murdered.

Many of the chief lords of Parthia being intimidated by the cruelty of Phrahates, retired into foreign countries: and among those one Monœses, a person of great distinction, as well as skill and experience in war. This man, having fled to Antony, soon gained his confidence, and was by him easily prevailed upon to engage in a war against his countrymen. But Phrahates justly dreading the consequences of such a person's defection, sent a solemn embassy to invite him home on such terms as he should think fit to accept; which greatly provoked Antony; though he did not hinder him from returning, lest others should thereby be discouraged from coming over to him. He therefore dismissed him with great civility, sending ambassadors at the same time to Phrahates to treat of a peace. Thus he hoped to divert the Parthian monarch's attention from making the necessary preparations for war, and that he should be able to fall upon him on the spring when he was in no condition to make resistance. But herein he was greatly disappointed; for on his arrival at the Euphrates, which he intended to pass, and enter the Parthian dominions on that side, he found all the passes so well guarded, that he thought proper to enter Media with a design first to reduce that country, and then to enter Parthia.

21 Antony betrayed by Artabazus, king of Armenia.

This plan had been suggested to him by Artabazus king of Armenia, who in the end betrayed him; for instead of conducting the army the straight way from Zeugma on the Euphrates, to the Araxes which parted Media from Armenia, and which was about 500 miles distant from the place whence he first set out, Artabazus led them over the rocks and mountains so far about, that the army had marched above 1000 miles before they reached the borders of Media, where they intended to begin the war. Thus they were not only greatly fatigued but had not sufficient time, the year being far spent, to put in execution the design on which they had come. However, as Antony was impatient to get back to Cleopatra, he left behind him most of the baggage of the army, and 300 waggons loaded with battering rams and other military engines for sieges; appointing Statianus, one of his lieutenants, with a body of 10,000 men, to guard them, and to bring them, by slower marches, after the army.

army. With the rest of the forces he marched more than 300 miles before the rest, without allowing his men any respite till he arrived at Praaspa or Phrahata, the capital of Media, which he immediately invested. But the Parthians, well knowing that he could not make any progress without his military machines, passed by his army, in order to attack Statianus; which they did with such success, that the body commanded by him were all to a man cut off, and all their military engines taken, among which was a battering ram 80 feet long.

22
Ten thousand Romans cut off.

Antony, notwithstanding this disaster, continued the siege of Praaspa; but was daily harassed by sallies of the garrison from within, and the enemy's army without. At last he began to think of a retreat when his provisions were almost exhausted, finding it impossible to become master of the city. But as he was to march 300 miles through the enemy's country, he thought proper first to send ambassadors to the Parthian monarch, acquainting him that the Roman people were willing to allow him a peace, provided he would restore the standards and prisoners taken at Carrhæ. Phrahates received the ambassadors, sitting on a golden throne; and, after having bitterly inveighed against the avarice and unbounded ambition of the Romans, told them that he would not part with the standards and prisoners; but that if Antony would immediately raise the siege of Praaspa, he would suffer him to retire unmolested.

23
Antony leaves Parthia in great distress.

Antony, who was reduced to great straits, no sooner received this answer than he broke up the siege, and marched towards Armenia. However, Phrahates was not so good as his word; for the Romans were attacked by the enemy no fewer than 18 times on their march, and were thrice in the utmost danger of being cut off. A famine also raged in the Roman army; upon which they began to desert to the enemy; and indeed Antony would probably have been left by himself, had not the Parthians, in a very cruel as well as impolitic manner, murdered all those who fled to them in sight of the rest. At last, after having lost 32,000 men, and being reduced to such despair that he was with difficulty prevented from laying violent hands on himself, he reached the river Araxes; when his men, finding themselves out of the reach of the enemy, fell down on the ground, and kissed it with tears of joy.

Antony was no sooner gone, than the kings of Media and Parthia quarrelled about the booty they had taken; and after various contests Phrahates reduced all Media and Armenia. After this, being elated with his conquests, he oppressed his subjects in such a cruel and tyrannical manner, that a civil war took place; in which the competitors were alternately driven out and restored, till the year 50, when one Vologeses, the son of Gotarzes, a former king, became peaceable possessor of the throne. He carried on some wars against the Romans, but with very indifferent success, and at last gladly consented to a renewal of the ancient treaties with that powerful people.

24
Parthia subdued by Trajan.

From this time the Parthian history affords nothing remarkable till the reign of the emperor Trajan; when the Parthian king, by name *Cosdroes*, infringed the treaty with Rome, by driving out the king of Armenia. Upon this Trajan, who was glad of any pretence to quarrel with the Parthians, immediately hastened into Armenia. His arrival there was so sudden and unexpected, that he reduced almost the whole country without opposition; and took prisoner Parthamasiris, the king whom the Parthians had set up. After this he entered Mesopotamia, took the city of Nisibis, and reduced to a Roman province the whole of that wealthy country.

Early in the spring of the following year, Trajan, who had kept his winter quarters in Syria, took the field again; but was warmly opposed by Cosdroes.—He found him encamped on the banks of the Euphrates, with a design to dispute his passage: which he did with such vigour, that the emperor, after having several times attempted to ford that river, and been always repulsed with great slaughter, was obliged to cause boats to be built on the neighbouring mountains, which he privately conveyed from thence on carriages to the water side; and having in the night time formed a bridge with them, he passed his army the next day; but not without great loss and danger, the Parthians harassing his men the whole time with incessant showers of arrows, which did great execution. Having gained the opposite bank, he advanced boldly into Assyria, the Parthians flying everywhere before him, and made himself master of Arbela. Thence he pursued his march; subduing, with incredible rapidity, countries where the Roman standard had never been displayed before. Babylonia, or the province of Babylon, voluntarily submitted to him. The city itself was, after a vigorous resistance, taken by storm; by which means he became master of all Chaldea and Assyria, the two richest provinces of the Parthian empire. From Babylon he marched to Ctesiphon, the metropolis of the Parthian monarchy; which he besieged, and at last reduced. But as to the particulars of these great conquests, we are quite in the dark; this expedition, however glorious to the Roman name, being rather hinted at than described, by the writers of those times. While Trajan was thus making war in the heart of the enemy's country, Cosdroes, having recruited his army, marched into Mesopotamia, with a design to recover that country, and cut off all communication between the Roman army and Syria. On his arrival in that province, the inhabitants flocked to him from all parts; and most of the cities, driving out the garrisons left by Trajan, opened their gates to him. Hereupon the emperor detached Lucius and Maximus, two of his chief commanders, into Mesopotamia, to keep such cities in awe as had not revolted, and to open a communication with Syria. Maximus was met by Cosdroes; and having ventured a battle, his army was entirely defeated, and himself killed. But Lucius being joined by Euricius and Clarius, two other commanders sent by Trajan with fresh supplies, gained considerable advantages over the enemy, and retook the cities of Nisibis and Seleucia, which had revolted.

And now Trajan, seeing himself possessed of all the best and most fruitful provinces of the Parthian empire, but at the same time being well apprised that he could not, without a vast expence, maintain his conquests, nor keep in subjection so fierce and warlike a people at such a distance from Italy; resolved to set over them a king of his own choosing, who should hold the crown of him and his successors, and acknowledge them

Parthia.

25 Parthanaspates appointed king by the Roman emperor, but soon after driven out.

them as his lords and sovereigns. With this view he repaired to Ctesiphon; and having there assembled the chief men of the nation, he crowned one of the royal family, by name *Parthanaspates*, king of Parthia, obliging all who were present to pay him their allegiance. He chose Parthanaspates, because that prince had joined him at his first entering the Parthian dominions, conducted him with great fidelity, and shown on all occasions an extraordinary attachment to the Romans. Thus the Parthians were at last subdued, and their kingdom made tributary to Rome. But they did not long continue in this state of subjection: for they no sooner heard of Trajan's death, which happened shortly after, than, taking up arms, they drove Parthanaspates from the throne; and recalling Cosdroes, who had retired into the country of the Hyrcanians, openly revolted from Rome. Adrian, who was then commander in chief of all the forces in the east, and soon after acknowledged emperor by the army, did not care, though he was at that time in Syria with a very numerous army, to engage in a new war with the Parthians; but contented himself with preserving the ancient limits of the empire, without any ambitious prospects of further conquests. Therefore, in the beginning of his reign, he abandoned those provinces beyond the Euphrates which Trajan had conquered; withdrew the Roman garrisons from Mesopotamia; and, for the greater safety of other places, made the Euphrates the boundary of, and barrier in, those parts, posting his legions along the banks of that river.

26 Unsuccessful wars of Vologeses with the Romans.

Cosdroes died after a long reign, and was succeeded by his eldest son Vologeses: in whose reign the Alani breaking into Media, then subject to the Parthians, committed there great devastations; but were prevailed upon, with rich presents sent them by Vologeses, to abandon that kingdom, and return home. Upon their retreat, Vologeses, having no enemy to contend with at home, fell unexpectedly upon Armenia; surprised the legions there; and having cut them all in pieces to a man, entered Syria; defeated with great slaughter Attilius Cornelianus, governor of that province; and advanced without opposition to the neighbourhood of Antioch; putting everywhere the Romans, and those who favoured them, to the sword. Hereupon the emperor Verus, by the advice of his colleague Antoninus surnamed the *Philosopher*, leaving Rome, hastened into Syria: and having driven the Parthians out of that province, ordered Statius Priscus to invade Armenia; and Cassius, with Martius Verus to enter the Parthian territories, and carry the war into the enemy's country. Priscus made himself master of Artaxata; and in one campaign drove the Parthians, though not without great loss on his side, quite out of Armenia. Cassius, on the other hand, having in several encounters defeated Vologeses, tho' he had an army of 400,000 men under his command, reduced, in four years time, all those provinces which had formerly submitted to Trajan, took Seleucia, burnt and plundered the famous cities of Babylon and Ctesiphon, with the stately palaces of the Parthian monarchs, and struck terror into the most remote provinces of that great empire, On his return, he lost above half the number of his forces by sickness and famine; so that, after all, the Romans, as Spartianus observes, had no great reason to boast of their victories and conquests.

Parthia.

However, Verus, who had never stirred during the whole time of the war from Antioch and Daphne, took upon him the lofty titles of *Parthicus* and *Armenicus*, as if he had acquired them justly in the midst of his pleasures and debaucheries. After the revolt and death of Cassius, Antoninus the Philosopher repaired into Syria to settle the affairs of that province. On his arrival there, he was met by ambassadors from Vologeses; who having recovered most of the provinces subdued by Cassius, and being unwilling either to part with them or engage in a new war, solicited the emperor to confirm him in the possession of them, promising to hold them of him, and to acknowledge the sovereignty of Rome. To these terms Antoninus readily agreed, and a peace was accordingly concluded between the two empires; which Vologeses did not long enjoy, being soon after carried off by a distemper, and not murdered by his own subjects, as we read in Constantinus Manasses, who calls him *Belegeses*.

27 Ctesiphon taken by Severus.

Upon his death, Vologeses III. the son of his brother Sanatruces, and grandson of Cosdroes, was raised to the throne. He sided with Niger against the emperor Severus: who thereupon having settled matters at home, marched with all his forces against him; and advancing to the city of Ctesiphon, whither he had retired, laid close siege to that metropolis. Vologeses made a most gallant defence: but the city, after a long siege, and much bloodshed on both sides, was at length taken by assault. The king's treasures, with his wives and children, fell into the emperor's hands: but Vologeses himself had the good luck to make his escape; which was a great disappointment to Severus, who immediately despatched an express to acquaint the senate with the success that had attended him in his expedition against the only nation that was then formidable to Rome. But he had no sooner crossed the Euphrates, than Vologeses recovered all the provinces except Mesopotamia, which he had reduced. These expeditions were chargeable to the Romans, and cost them much blood, without reaping any advantages from them; for as they had not sufficient forces to keep in awe the provinces they had subdued, the inhabitants, greatly attached to the family of Arsaces, never failed to return to their ancient obedience as soon as the Roman armies were withdrawn. Vologeses was soon after engaged in a war still more troublesome and destructive, with his brother Artabanus, who, encouraged by some of the discontented nobles, attempted to rob him of the crown, and place it on his own head. Vologeses gained several victories over his brother and rebellious subjects; but died before he could restore the empire to its former tranquillity.

Artabanus, who had a numerous army at his devotion, did not meet with any opposition in seizing the throne, vacant by the death of his brother, though Tiridates had a better title to it, as being his elder brother. He had scarce settled the affairs of his kingdom, when the emperor Caracalla, desirous to signalize himself as some of his predecessors had done, by some memorable exploit against the Parthians, sent a solemn embassy to him, desiring his daughter in marriage. Artabanus, overjoyed at this proposal, which

which he thought would be attended with a lasting peace between the two empires, received the ambassadors with all possible marks of honour, and readily complied with their request. Soon after, Caracalla sent a second embassy to acquaint the king that he was coming to solemnize the nuptials; whereupon Artabanus went to meet him attended with the chief of the nobility and his best troops, all unarmed, and in most pompous habits: but this peaceable train no sooner approached the Roman army, than the soldiers, on a signal given them, falling upon the king's retinue, made a most terrible slaughter of the unarmed multitude, Artabanus himself escaping with great difficulty. The treacherous Caracalla, having gained by this exploit great booty, and, as he thought, no less glory, wrote a long and boasting letter to the senate, assuming the title of *Parthicus* for this piece of treachery; as he had before that of *Germanicus*, for murdering, in like manner, some of the German nobility.

28
Infamous treachery of the emperor Caracalla.

Artabanus, resolving to make the Romans pay dear for their inhuman and barbarous treachery, raised the most numerous army that had ever been known in Parthia, crossed the Euphrates, and entered Syria, putting all to fire and sword. But Caracalla being murdered before this invasion, Macrinus, who had succeeded him, met the Parthians at the head of a mighty army, composed of many legions, and all the auxiliaries of the states of Asia. The two armies no sooner came in sight of each other, but they engaged with the utmost fury. The battle continued two days; both Romans and Parthians fighting so obstinately, that night only parted them, without any apparent advantage on either side; though both retired when night had put an end to the contest, crying, Victory, victory. The field of battle was covered all over with dead bodies, there being already above 40,000 killed, including both Romans and Parthians: nevertheless Artabanus was heard to say, that the battle was only begun, and that he would continue it till either the Parthians or Romans were all to a man cut in pieces. But Macrinus, being well apprised that the king came highly enraged against Caracalla in particular, and dreading the consequences which would attend the destruction of his army, sent a herald to Artabanus, acquainting him with the death of Caracalla, and proposing an alliance between the two empires. The king, understanding that his great enemy was dead, readily embraced the proposals of peace and amity, upon condition that all the prisoners who had been taken by the treachery of Caracalla should be immediately restored, and a large sum of money paid him to defray the expences of the war.

29
A desperate battle between the Parthians and Romans.

These articles being performed without delay or hesitation, Artabanus returned into Parthia, and Macrinus to Antioch.

30
The Persians revolt, and overthrow the Parthian empire.

As Artabanus lost on this occasion the flower of his army, Artaxerxes, a Persian of mean descent, but of great courage and experience in war, revolting from the Parthians, prevailed on his countrymen to join him, and attempt the recovery of the sovereign power, which he said they had been unjustly deprived of, first by the Macedonians, and afterwards by the Parthians, their vassals. Artabanus, upon the news of this revolt, marched with the whole strength of his kingdom to suppress it; but being met by Artaxerxes at the head of a no less powerful army, a bloody battle ensued, which is said to have lasted three days. At length the Parthians, though they behaved with the utmost bravery, and fought like men in despair, were forced to yield to the Persians, who were commanded by a more experienced leader. Most of their troops were cut off in the flight; and the king himself was taken prisoner, and soon after put to death at Artaxerxes's order. The Parthians, having lost in this fatal engagement both their king and their army, were forced to submit to the conqueror, and become vassals to a nation which had been subject to them for the space of 475 years.



For an account of the manners, customs, &c. of the ancient Parthians, see the article PERSIA.

PARTI, PARTIE, *Party*, or *Parted*, in heraldry, is applied to a shield or escutcheon, denoting it divided or marked out into partitions.

*PARTI per pale*, is when the shield is divided perpendicularly into two halves, by a cut in the middle from top to bottom.

*PARTI per fess*, is when the cut is across the middle from side to side.

*PARTI per bend dexter*, is when the cut comes from the upper corner of the shield on the right hand, and descends athwart to the opposite lower corner.

*PARTI per bend sinister*, is when the cut, coming from the upper left corner, descends across to the opposite lower one.

All these partitions, according to M. de la Colombiere, have their origin from the cuts and bruises that have appeared on shields after engagements; and, being proofs of the dangers to which the bearers had been exposed, they gained them esteem: for which reason they were transmitted to posterity, and became arms and marks of honour to their future families.

PARTIALITY. See *SELF-partiality* and PREJUDICE.

PARTICIPLE, in grammar, an adjective formed of a verb; so called, because it participates partly of the properties of a noun, and partly of those of a verb. See GRAMMAR.

PARTICLE, in physiology, the minute part of a body, an assemblage of which constitutes all natural bodies.

In the new philosophy, particle is often used in the same sense with atom in the ancient Epicurean philosophy, and corpuscle in the latter. Some writers, however, distinguish them; making particle an assemblage or composition of two or more primitive and physically indivisible corpuscles or atoms; and corpuscle, or little body, an assemblage or mass of several particles or secondary corpuscles. The distinction, however, is of little moment; and, as to most purposes of physics, particle may be understood as synonymous with corpuscle. Particles are then the elements of bodies: it is the various arrangement and texture of these, with the difference of the cohesion, &c. that constitute the various kinds of bodies, hard, soft, liquid, dry, heavy, light, &c. The smallest particles or corpuscles cohere with the strongest attractions, and always compose bigger particles of weaker cohesion; and many of these cohering compose bigger particles, whose vigour is still weaker; and thus on for divers successions, till the progression end in the biggest particles, whereon the operations in chemistry, and the

colours of natural bodies, depend, and which, by cohering, compoſe bodies of ſenſible bulks.

The coheſion of the particles of matter, according to the Epicureans, was effected by hooked atoms; the Ariſtotelians thought it managed by reſt, that is, by nothing at all. But Sir Iſaac Newton ſhows it is done by means of a certain power, whereby the particles mutually attract or tend towards each other, which is ſtill perhaps giving a fact without a cauſe. By this attraction of the particles he ſhows that moſt of the phenomena of the leſſer bodies are affected, as thoſe of the heavenly bodies are by the attraction of gravity. See Attraction and Cohesion.

Particle, a term in theology, uſed in the Latin church for the crumbs or little pieces of conſecrated bread, called in the Greek church μεριδες. The Greeks have a particular ceremony, called των μεριδων, *of the particles*, wherein certain crumbs of bread, not conſecrated, are offered up in honour of the Virgin, St John Baptiſt, and ſeveral other ſaints. They alſo give them the name of προσφορα, *oblatio*. Gabriel archbiſhop of Philadelphia wrote a little treatiſe expreſs περι των μεριδων, wherein he endeavours to ſhow the antiquity of this ceremony, in that it is mentioned in the liturgies of St Chryſoſtom and Baſil. There has been much controverſy on this head between the reformed and catholic divines. Aubertin and Blondel explain a paſſage in the theory of Germanus patriarch of Conſtantinople, where he mentions the ceremony of the particles as in uſe in his time, in favour of the former; Meſſieurs de Port Royal conteſt the explanation; but M. Simon, in his notes on Gabriel of Philadelphia, endeavours to ſhow that the paſſage itſelf is an interpolation, not being found in the ancient copies of Germanus, and conſequently that the diſpute is very ill grounded.

*Organic* Particles, are thoſe ſmall moving bodies which are imperceptible without the help of glaſſes; for beſides thoſe animals which are perceptible to the ſight, ſome naturaliſts reckon this exceedingly ſmall ſpecies as a ſeparate claſs, if not of animals properly ſo called, at leaſt of moving bodies, which are found in the ſemen of animals, and which cannot be ſeen without the help of the microſcope. In conſequence of theſe obſervations, different ſyſtems of generation have been propoſed concerning the ſpermatic worms of the male and the eggs of the female. In the ſecond volume of Buffon's Natural Hiſtory, ſeveral experiments are related, tending to ſhow that thoſe moving bodies which we diſcover by the help of glaſſes in the male ſemen are not real animals, but organic, lively, active, and indeſtructible molecules, which poſſeſs the property of becoming a new organized body ſimilar to that from which they were extracted. Buffon found ſuch bodies in the female as well as in the male ſemen; and he ſuppoſes that the moving bodies which he obſerved with the microſcope in infuſions of the germs of plants are likewiſe vegetable organic molecules. Needham, Wriſberg, Spalanzani, and ſeveral other writers on the animal economy, have purſued the ſame track with M. de Buffon.

Some ſuppoſe that theſe organic molecules in the ſemen anſwer no purpoſe but to excite the venereal deſire: but ſuch an opinion cannot be well founded; for eunuchs, who have no ſeminal liquor, are nevertheleſs ſubject to venereal deſire. With reſpect to the beautiful experiments which have been made with the microſcope on organic molecules, M. Bonnet, that learned and excellent obſerver of nature, remarks that they ſeem to carry us to the fartheſt verge of the ſenſible creation, did not reaſon teach us that the ſmalleſt viſible globule of ſeminal liquor is the commencement of another univerſe, which, from its infinite ſmallneſs, is beyond the reach of our beſt microſcopes. —*Animalcules*, properly ſo called, muſt not be confounded with the wonderful organic particles of Buffon. See Animalcule.

Particle, in grammar, a denomination for all thoſe ſmall words that tie or unite others, or that expreſs the modes or manners of words. See Grammar.

PARTING, in metallurgy. See Metallurgy.

Parting, in chemiſtry, an operation by which gold and ſilver are ſeparated from each other. As theſe two metals reſiſt equally well the action of fire and of lead, they muſt therefore be ſeparated by other methods. This ſeparation could not be effected if they were not ſoluble by different menſtruums.

Nitrous acid, marine acid, and ſulphur, which cannot diſſolve gold, attack ſilver very eaſily; and therefore theſe three agents furniſh methods of ſeparating ſilver from gold, or of the operation called *parting*.

Parting by nitrous acid is the moſt convenient, and therefore moſt uſed, and even almoſt the only one employed by goldſmiths and coiners: wherefore it is called ſimply *parting*. That made with the marine acid is only made by cementation, and is known by the name of *concentrated parting*. Laſtly, Parting by ſulphur is made by fuſion, which the chemiſts call the *dry way*, and is therefore called *dry parting*.

*Parting by Aquafortis*. Although parting by aquafortis be eaſy, as we have ſaid, it cannot however ſucceed or be very exact, unleſs we attend to ſome eſſential circumſtances.

1. The gold and ſilver muſt be in a proper proportion: for if the gold was in too great quantity, the ſilver would be covered and guarded by it from the action of the acid.

Therefore, when eſſayers do not know the proportion of theſe two metals in the maſs to be operated upon, they diſcover it by the following method.

They have a certain number of needles compoſed of gold and ſilver allayed together in graduated proportions, and the allay of each needle is known by a mark upon it. Theſe are called *proof needles*.

When eſſayers want to know nearly the proportion of gold and ſilver in a maſs, they rub this maſs upon a touchſtone, ſo as to leave a mark upon it. They then make marks upon the touchſtone with ſome of the needles the colour of which they think comes neareſt to that of the maſs. By comparing the marks of theſe needles with the mark of the maſs, they diſcover nearly the proportion of the gold and ſilver in the maſs.

If this trial ſhows, that in any given maſs the ſilver is not to the gold as three to one, this maſs is improper for the operation of parting by aquafortis. In this caſe, the quantity of ſilver neceſſary to make an allay of that proportion muſt be added.

This operation is called *quartation*, probably becauſe it reduces the gold to a fourth part of the whole maſs.

2. That the parting may be exact, the nitrous acid or

 or aquafortis employed must be very pure, and especially free from mixture of vitriolic and marine acids. For if this was not attended to, a quantity of silver proportionable to these two foreign acids would be separated during the solution; and this portion of silver reduced by these acids to vitriol of silver and to luna cornea would remain mingled with the gold, which consequently would not be entirely purified by the operation.

When the metallic mass is properly allayed, it is to be reduced to plates, rolled up spirally, called cornets; or to grains. These are to be put into a matrass, and upon them a quantity of aquafortis is to be poured, the weight of which is to that of the silver as three to two: and as the nitrous acid employed for this operation is rather weak, the solution is assisted, especially at first, by the heat of a sand bath, in which the matrass is to be placed. When, notwithstanding the heat, no further mark of solution appears, the aquafortis charged with silver is to be decanted. Fresh nitrous acid is to be poured into the matrass, stronger than the former, and in less quantity, which must be boiled on the residuous mass, and decanted as the former. Aquafortis must even be boiled a third time on the remaining gold, that all the silver may be certainly dissolved. The gold is then to be washed with boiling water. This gold is very pure if the operation has been performed with due attention. It is called *gold of parting*.

No addition of silver is required, if the quantity of silver of the mass is evidently much more considerable than that of the gold: persons who have not proof needles and other apparatus to determine the proportion of the allay, may add to the gold an indeterminate quantity of silver, observing that this quantity be rather too great than too small, and so considerable as to render the mass nearly as white as silver; for a large quantity of silver is rather favourable than hurtful to the operation: It has no other inconvenience than an useless expence, as the larger the quantity is of silver the more aquafortis must be employed. We ought to attend to this fact, that the colour of gold is scarcely perceptible in a mass two-thirds of which is silver and one-third is gold; this colour then must be much less perceptible when the gold is only one-fourth part, or less, of the whole mass.

If the quantity of gold exceeds that of the silver, the mass may be exposed to the action of aqua regia, which would be a kind of inverse parting, because the gold is disolved in that menstruum, and the silver is not, but rather reduced to a luna cornea, which remains in form of a precipitate after the operation. But this method is not much practised, for the following reasons.

First, The gold cannot be easily separated from the aqua-regia: for if the parting has been made with an aqua-regia prepared with sal ammoniac, or if the gold be precipitated by a volatile alkali, this gold has a fulminating quality, and its reduction requires particular operations. If the aqua-regia has been made with spirit of salt, and the precipitation effected by a fixed alkali, the gold will not then be fulminating, but the precipitation will be very slow, and probably incomplete.

Secondly, In the parting by aqua-regia, the silver is indeed precipitated into a lunea cornea, and thus separated; but this separation is not perfect, as a small quantity of luna cornea will always remain dissolved by the acids, if this solution even could be only effected by the superabundant water of these acids. Accordingly the silver is not so accurately separated from the gold by aqua-regia, as the gold is from the silver by aquafortis.

The gold, after the parting by aquafortis, is much more easily collected when it remains in small masses than when it is reduced to a powder.

When the mass has been regularly quarted, that is, when it contains three parts of silver and one part of gold, we must employ, particularly for the first solution, an aquafortis so weakened that heat is required to assist the solution of the silver; by which means the solution is made gently; and the gold which remains preserves the form of the small masses before the solution. If the aquafortis employed were stronger, the parts of the gold would be disunited and reduced to the form of a powder, from the activity with which the solution would be made.

We may indeed part by aquafortis a mass containing two parts of silver to one part of gold: but then the aquafortis must be stronger; and if the solution be not too much hastened, the gold will more easily remain in masses after the operation. In both cases, the gold will be found to be tarnished and blackened, probably from what was lately called the *phlogiston* of the nitrous acid. Its parts have no adhesion together, because the silver dissolved from it has left many interstices; and the cornets or grains of this gold will be easily broken, unless they be handled very carefully. To give them more solidity, they are generally put into a test under a muffle and made red hot; during which operation they contract considerably, and their parts are approximated. These pieces of gold are then found to be rendered much more solid, so that they may be handled without being broken. By this operation also the gold resumes its colour and lustre; and as it generally has the figure of cornets, it is called *gold in cornets*, or *grain gold*. Essayers avoid melting it, as they choose to preserve this form, which shows that it has been parted.

The gold and silver thus operated upon ought to have been previously refined by lead, and freed from all allay of other metallic matters, so that the gold which remains should be as pure as is possible. However, as this is the only metal which resists the action of aquafortis, it might be purified by parting from all other metallic substances; but this is not generally done, for several reasons. First, because the refining by lead is more expeditious and convenient for the separation of the gold from the imperfect metals; secondly, because the silver, when afterwards separated from the aquafortis, is pure; lastly, because most imperfect metals do not remain completely and entirely dissolved in nitrous acid; from the portion of phlogiston which this acid deprives them of, the gold would be found after the parting mixed with the part of these metals which is precipitated.

The gold remaining after the parting ought to be well washed, to cleanse it from any of the solution of silver which might adhere to it; and for this purpose distilled water ought to be used, or at least water the purity of

 of which has been ascertained by its not forming a precipitate with a solution of silver, because such a precipitate would alter the purity of the gold.

The silver dissolved in the aquafortis may be separated either by distillation, in which case all the aquafortis is recovered very pure, and fit for another parting; or it may be precipitated by some substance which has a greater affinity than this metal with nitrous acid. Copper is generally employed for this purpose at the mint.

The solution of silver is put into copper vessels. The aquafortis dissolves the copper, and the silver precipitates. When the silver is all precipitated, the new solution is decanted, which is then a solution of copper. The precipitate is to be well washed, and may be melted into an ingot. It is called *parted silver*. When this silver has been obtained from a mass which had been refined by lead, and when it has been well washed from the solution of copper, it is very pure.

Mr Cramer observes justly in his Treatise on Essaying, that however accurately the operation of parting has been performed, a small portion of silver always remains united with the gold, if the parting has been made by aquafortis; or a small portion of the gold remains united with the silver, if the parting has been made by aqua-regia: and he estimates this small allay to be from a two hundredth to a hundred and fiftieth part; which quantity may be considered as nothing for ordinary purposes, but may become sensible in accurate chemical experiments. *Chem. Dict.*

The mass of gold and silver to be quarted ought previously to be granulated; which may be done by melting it in a crucible, and pouring it into a large vessel full of cold water, while at the same time a rapid circular motion is given to the water by quickly stirring it round with a stick or broom.

The vessels generally used for this operation, called *parting glasses*, have the form of truncated cones, the bottom being commonly about seven inches wide, the aperture about one or two inches wide, and the height about 12 inches. These glass vessels ought to have been well annealed, and chosen free from flaws; as one of the chief inconveniences attending the operation is, that the glasses are apt to crack by exposure to cold, and even when touched by the hand. Some operators secure their glasses by a coating. For this purpose they spread a mixture of quicklime slaked with beer and whites of eggs upon linen cloth, which they wrap round the lower part of the vessel, leaving the upper part uncovered, that they may see the progress of the operation; and over this cloth they apply a composition of clay and hair. Schlutter advises to put the parting glasses containing some water, and supported by trevets, with fire under them. When the heat communicated by the water is too great, it may be diminished by adding cold water, which must be done very carefully by pouring against the sides of the pan, to prevent too sudden an application of cold to the parting glass. The intention of this contrivance is, that the contents of the glasses, if these should break, may be received by the copper vessel. Into a glass 15 inches high, and 10 or 12 inches wide at bottom, placed in a copper pan 12 inches wide at bottom, 15 inches wide at top, and 10 inches high, he usually put about 80 ounces of metal, with twice as much aquafortis.

The aquafortis ought to be so strong as to be capable of acting sensibly on silver when cold, but not so strong as to act violently. If the aquafortis be very strong, however pure, and if the vessels be well closed, a small quantity of the gold will be dissolved along with the silver, which is to be guarded against.

Little heat ought to be applied at the beginning, the liquor being apt to swell and rise over the vessel; but when the acid is nearly saturated, the heat may be safely increased.

When the solution ceases, which may be known by the discontinuance of the effervescence, or emission of air bubbles, the liquor is to be poured off. If any grains appear entire, more aquafortis must be added, that all the silver may be dissolved. If the operation has been performed slowly, the remaining gold will have still the form of distinct masses, which are to receive solidity and colour by fire, in the manner directed by the author of the dictionary. If the operation has been performed hastily, the gold will have the appearance of a black mud or powder, which after five or six washings with pure water must be melted.

The silver is usually recovered by precipitating it from the aquafortis by means of copper vessels into which the liquor is poured, or of plates of copper which are thrown along with the liquor into glass vessels. A considerable heat is required to accelerate this precipitation. Dr Lewis says, he has observed that when the aquafortis was perfectly saturated with silver, no precipitation was occasioned by plates of copper, till a drop or two of aquafortis was added to the liquor, and then the precipitation began and continued as usual.

The precipitated silver must be well washed in boiling water, and fused with some nitre; the use of which is to scorify any cupreous particles which may adhere to the silver.

From the solution of copper in aquafortis, a blue pigment, called *verditer*, is obtained by precipitation with whiting. *Notes to Chem. Dict.*

*Concentrated* PARTING, also called *Parting by Cementation*, because it is actually performed by cementation, is used when the quantity of it is so great in proportion to the silver, that it cannot be separated by aquafortis. This operation is done in the following manner.

A cement is first prepared, composed of four parts of bricks powdered and sifted, of one part of green vitriol calcined till it becomes red, and of one part of common salt. The whole is very accurately mixed together, and a firm paste is made of it by moistening it with a little water or urine. This cement is called *cement royal*, because it is employed to purify gold, which is considered by chemists as the king of metals.

The gold to be cemented is to be reduced to plates as thin as small pieces of money. At the bottom of the crucible or cementing pot, a stratum of cement, of the thickness of a finger, is to be put, which is to be covered with plates of gold; upon these another stratum of cement is to be laid, and then more plates of gold, till the crucible or pot is filled with these alternate strata of cement and of gold. The whole is then to be covered with a lid, which is to be luted with a mixture of clay and sand. This pot is to be placed in a furnace, or oven, and heated by degrees till it is moderately

moderately red, which heat is to be continued during 24 hours. The heat must not be so great as to melt the gold. The pot or crucible is then left to cool, and the gold is to be carefully separated from the cement, and boiled at different times in a large quantity of pure water. This gold is to be essayed upon a touchstone or otherwise; and if it be found not sufficiently purified, it is to be cemented a second time in the same manner.

The vitriolic acid of the bricks and of the calcined vitriol disengages the acid of the common salt during this cementation: and this latter acid dissolves the silver allayed with the gold, and separates it by that means.

This experiment proves, that although marine acid, while it is liquid, cannot attack silver, it is nevertheless a powerful solvent of that metal. But for this purpose it must be applied to the silver in the state of vapours, extremely concentrated, and assisted with a considerable heat. All these circumstances are united in the concentrated parting.

This experiment proves also, that notwithstanding all these circumstances, which favour the action of the marine acid, it is incapable of dissolving gold.

Lastly, The marine acid in this state more effectually dissolves the silver than the nitrous acid does in the parting by aquafortis, since this operation succeeds well when the silver is in so small a proportion as that it would be protected from the action of the nitrous acid in the ordinary parting.

Instead of sea salt, nitre may be used with equal success: because the nitrous acid is then put in a state to attack the silver, notwithstanding the quantity of gold which covers it.

*Dry Parting.* Dry parting, or parting by fusion, is performed by sulphur, which has the property of uniting easily with silver, while it does not attack gold.

This method of separating these two metals would be the cheapest, the most expeditious and convenient of any, if the sulphur could dissolve the silver, and separate it from the gold as well and as easily as nitrous acid does: but, on the contrary, we are obliged to employ a particular treatment, and a kind of concentration, to begin the union of the sulphur allayed with gold. Then repeated and troublesome fusions must be made, in each of which we are obliged to add different intermediate substances, and particularly the metals which have the strongest affinity with sulphur, to assist the precipitation, which in that case does not give a regulus of pure gold, but a gold still allayed with much silver, and even with a part of the precipitating metals; so that, to complete the operation, cupellation is necessary, and also parting by aquafortis.

From what we have said concerning this operation, we may perceive, that it ought not to be made but when the quantity of silver with which the gold is allayed is so great, that the quantity of gold which might be obtained by the ordinary parting is not sufficient to pay the expences; and that it is only proper for concentrating a larger quantity of gold in a smaller quantity of silver. As this dry parting is troublesome, and even expensive, it ought not to be undertaken but on a considerable quantity of silver allayed with gold. Accordingly Cramer, Schlutter, Schlinder, and all good chemists and artists, who have given processes for the dry parting, recommend its use only in the above-mentioned cases. We wish that this operation could be improved: it would be much more advantageous if it could be done by two or three fusions; and if by these an exact separation could be obtained of a small quantity of gold mixed with a large quantity of silver. *Chem. Dict.*



As this operation for extracting a small quantity of gold from a large quantity of silver is, notwithstanding its inconveniences, approved by Schlutter, Scheffer, and other authors, and practised in Hartz, we shall add what Dr Lewis, in his excellent History of Gold, has said upon the subject.

The most advantageous method of separating a small portion of gold from a large one of silver, appears to be by means of sulphur, which unites with and scorifies the silver without affecting the gold; but as sulphurated silver does not flow thin enough to suffer the small particles of gold diffused through it to reunite and settle at the bottom, some addition is necessary for collecting and carrying them down.

In order to the commixture with the sulphur, 50 or 60 pounds of the mixed metal, or as much as a large crucible will receive, are melted at once, and reduced into grains, by taking out the fluid matter, with a small crucible made red hot, and pouring it into cold water stirred with a rapid circular motion. From an eighth to a fifth of the granulated metal, according as it is richer or poorer in gold, is reserved, and the rest well mingled with an eighth of powdered sulphur. The grains enveloped with the sulphur are again put into the crucible, and the fire kept gentle for some time, that the silver, before it melts, may be thoroughly penetrated by the sulphur; if the fire was hastily urged, great part of the sulphur would be dissipated, without acting upon the metal.

If to sulphurated silver in fusion pure silver be added, the latter falls to the bottom, and forms there a distinct fluid not miscible with the other. The particles of gold, having no affinity with the sulphurated silver, join themselves to the pure silver, wherever they come in contact with it, and are thus transferred from the former into the latter, more or less perfectly according as the pure silver was more or less thoroughly diffused through the mixed. It is for this use that a part of the granulated metal was reserved. The sulphurated mass being brought into perfect fusion, and kept melted for near an hour in a close covered crucible, one-third of the reserved grains is thrown in; and as soon as this is melted, the whole is well stirred, that the fresh silver may be distributed through the mixed, to collect the gold from it. The stirring is performed with a wooden rod; an iron one would be corroded by the sulphur, so as to deprive the mixed of its due quantity of sulphur, and likewise render the subsequent purification of the silver more troublesome. The fusion being continued an hour longer, another third of the unsulphurated grains is added, and an hour after this the remainder; after which the fusion is further continued for some time, the matter being stirred at least every half hour from the beginning to the end, and the crucible kept closely covered in the intervals.

The sulphurated silver appears in fusion of a dark brown colour; after it has been kept melted for a cer-

tain time, a part of the sulphur having escaped from the top, the surface becomes white, and some bright drops of silver, about the size of pease, are perceived on it. When this happens, which is commonly in about three hours after the last addition of the reserved grains, sooner or later according as the crucible has been more or less closely covered, and the matter more or less stirred, the fire must be immediately discontinued; for otherwise more and more of the silver, thus losing its sulphur, would subside and mingle with the part at the bottom in which the gold is collected. The whole is poured out into an iron mortar greased and duly heated; or if the quantity is too large to be safely lifted at once, a part is first taken out from the top with a small crucible, and the rest poured into the mortar. The gold, diffused at first through the whole mass, is now found collected into a part of it at the bottom, amounting only to about as much as was reserved unsulphurated. This part may be separated from the sulphurated silver above it by a chissel and hammer; or more perfectly, the surface of the lower mass being generally rugged and unequal, by placing the whole mass with its bottom upwards in a crucible: the sulphurated part quickly melts, leaving unmelted that which contains the gold, which may thus be completely separated from the other. The sulphurated silver is essayed by keeping a portion of it in fusion in an open crucible till the sulphur is dissipated, and then dissolving it in aquafortis. If it should still be found to contain any gold, it is to be melted again; as much more unsulphurated silver is to be added as was employed in each of the former injections, and the fusion continued about an hour and a half.

The gold thus collected into a part of the silver may be further concentrated into a smaller part, by granulating the mass and repeating the whole process. The operation may be again and again repeated, till so much of the silver is separated, that the remainder may be parted by aquafortis without too much expence.

The foregoing process, according to Mr Schlutter, is practised at Rammelsberg in the Lower Hartz. The prevailing metal in the ore of Rammelsberg is lead: the quantity of lead is at most 40 pounds on a quintal or 100 pounds of the ore. The lead worked off on a test or concave hearth yields about 110 grains of silver, and the silver contains only a 384th part of gold; yet this little quantity of gold, amounting scarcely to a third of a grain in a hundred weight of this ore, is thus collected with profit. The author above mentioned confines this method of separation to such silver as is poor in gold, and reckons parting with aquafortis more advantageous where the gold amounts to above a 64th of the silver: he advises also not to attempt concentrating the gold too far, as a portion of it will always be taken up again by the silver. M. Scheffer, however, relates (in the Swedish Memoirs for the year 1752), that he has by this method brought the gold to perfect fineness; and that he has likewise collected all the gold which the silver contained; the silver of the last operations, which had taken up a portion of the gold, being reserved to be worked over again with a fresh quantity of gold holding silver. The sulphurated silver is purified by continuing it in fusion for some time with a large surface exposed to the air; the sulphur gradually exhales, and leaves the silver entire.



PARTISAN, in the art of war, a person dexterous in commanding a party; who, knowing the country well, is employed in getting intelligence, or surprising the enemy's convoy, &c. The word also means an officer sent out upon a party, with the command of a body of light troops, generally under the appellation of the partisan's corps. It is also necessary that this corps should be composed of infantry, light horse, and hussars.

PARTNERSHIP, is a contract among two or more persons, to carry on a certain business, at their joint expence, and share the gain or loss which arises from it. Of this there are four kinds.

I. Occasional joint trade, where two or more merchants agree to employ a certain sum in trade, and divide the gain or loss so soon as the adventure is brought to an issue. This kind of contract being generally private, the parties concerned are not liable for each other. If one of them purchase goods on trust, the furnisher, who grants the credit through confidence in him alone, has no recourse, in case of his insolvency, against the other partners. They are only answerable for the share of the adventure that belongs to the insolvent partner.

If it be proposed to carry the adventure farther than originally agreed on, any partner may withdraw his interest; and if it cannot be separated from the others, may insist that the whole shall be brought to an issue.

II. Standing companies, which are generally established by written contract between the parties, where the stock, the firm, duration, the division of the gain or loss, and other circumstances, are inserted.

All the partners are generally authorized to sign by the firm of the company, though this privilege may be confined to some of them by particular agreement. The firm ought only to be subscribed at the place where the copartnery is established. If a partner has occasion, when absent, to write a letter relating to their affairs, he subscribes his own name on account of the company. When the same partners carry on business at different places, they generally choose different firms for each. The signature of each partner is generally sent to new correspondents; and when a partner is admitted, although there be no alteration in the firm, his signature is transmitted, with an intimation of the change in the copartnery to all their correspondents. Houses that have been long established, often retain the old firm, though all the original partners be dead or withdrawn.

The powers of each partner are, in general, discretionary; but they ought not to act, in matters of importance, without consulting together, when there is an opportunity. No partner is liable to make good the loss arising from his judging wrong in a case where he had authority to act. If he exceeds his power, and the event prove unsuccessful, he must bear the loss; but if it prove successful, the gain belongs to the company: yet if he acquaints the company immediately of what he has done, they must either acquiesce therein, or leave him the chance of gain, as well as the risk of loss.

All debts contracted under the firm of the company are

Partnerfhip.

are binding on the whole partners, though the money was borrowed by one of them for his private ufe, without the confent of the reft. And if a partner exceeds his power, the others are neverthelefs obliged to implement his engagements; though they may render him refponfible for his mifbehaviour.

Although the fums to be advanced by the partners be limited by the contract, if there be a neceffity for raifing more money to anfwer emergencies or pay the debts of the company, the partners muft furnifh what is neceffary, in proportion to their fhares.

A debt to a company is not cancelled by the private debts of the partner: and when a partner becomes infolvent, the company is not bound for his debts beyond the extent of his fhare.

The debts of the company are preferable, on the company's effects, to the private debts of the partners.

Partnerfhip is generally diffolved by the death of a partner; yet, when there are more partners than two, it may, by agreement, fubfift among the furvivors. Sometimes it is ftipulated, that, in cafe of the death of a partner, his place fhall be fupplied by his fon, or fome other perfon condefcended on. The contract ought to fpecify the time and manner in which the furviving partners fhall reckon with the executors of the deceafed for his fhare of the ftock, and a reafonable time allowed for that purpofe.

When partnerfhip is diffolved, there are often outftanding debts that cannot be recovered for a long time, and effects that cannot eafily be difpofed of. The partnerfhip, though diffolved in other refpects, ftill fubfifts for the management of their outftanding affairs: and the money arifing from them is divided among the partners, or their reprefentatives, when it is recovered. But as this may protract the final fettlement of the company's affairs to a very inconvenient length, other methods are fometimes ufed to bring them to a conclufion, either in confequence of the original contract, or by agreement at the time of diffolution. Sometimes the debts and effects are fold by auction; fometimes they are divided among the partners; and when there are two partners, one divides them into fhares, as equal as poffible, and the other choofes either fhare he thinks beft.

If a partner withdraws, he continues refponfible for his former partners till it be publicly known that he hath done fo. A deed of feparation, regiftered at a public office, is fufficient prefumption of fuch notoriety.

III. Companies, where the bufinefs is conducted by officers. There are many companies of this kind in Britain, chiefly eftablifhed for purpofes which require a larger capital than private merchants can command. The laws with refpect to thefe companies, when not confirmed by public authority, are the fame as the former, but the articles of their agreement ufually very different. The capital is condefcended on; and divided into a certain number of fhares, whereof each partner may hold one or more, but is generally reftricted to a certain number. Any partner may transfer his fhare; and the company muft admit his affignee as a partner. The death of the partners has no effect on the company. No partner can act perfonally in the affairs of the company: but the execution of their bufinefs is intrufted to officers, for whom they are refponfible; and, when the partners are numerous, the fuperintendency of the officers is committed to directors chofen annually, or at other appointed times, by the partners.

Partnerfhip, Partridge.

IV. Companies incorporated by authority. A royal charter is neceffary to enable a company to hold lands, to have a common feal, and enjoy the other privileges of a corporation. A charter is fometimes procured, in order to limit the rifk of the partners: for, in every private company, the partners are liable for the debts, without limitation; in corporated focieties, they are only liable for their fhares in the ftock of the fociety. The incorporation of focieties is fometimes authorized by act of parliament: but this high authority is not neceffary, unlefs for conferring exclufive privileges.

Mr Paley fays, "I know of nothing upon the fubject of partnerfhip that requires explanation, but how the profits are to be divided where one partner contributes money and the other labour, which is a common cafe.

*Moral and Political Philofophy.*

"*Rule.* From the ftock of the partnerfhip deduct the fum advanced, and divide the remainder between the moneyed partner and the labouring partner, in the proportion of the intereft of the money to the wages of the labour, allowing fuch a rate of intereft as money might be borrowed for upon the fame fecurity, and fuch wages as a journeyman would require for the fame labour and truft.

"*Example.* A advances 1000l. but knows nothing of the bufinefs; B produces no money, but has been brought up to the bufinefs, and undertakes to conduct it. At the end of the year the ftock and effects of the partnerfhip amount to 1200l. confequently there are 200l. to be divided. Now nobody would lend money upon the event of the bufinefs fucceeding, which is A's fecurity, under 6 *per cent.* therefore A muft be allowed 60l. for the intereft of his money. B, before he engaged in the partnerfhip, earned 30l. a-year in the fame employment: his labour, therefore, ought to be valued at 30l. and the 200l. muft be divided between the partners in the proportion of 60 to 30; that is, A muft receive 133l. 6s. 8d. and B 66l. 13s. 4d. If there be nothing gained, A lofes his intereft, and B his labour, which is right. If the original ftock be diminifhed, by this rule B lofes only his labour as before; whereas A lofes his intereft and part of the principal; for which eventual difadvantage A is compenfated, by having the intereft of his money computed at 6 *per cent.* in the divifion of the profits when there is any. It is true, that the divifion of the profit is feldom forgotten in the conftitution of the partnerfhip; and is therefore commonly fettled by exprefs agreement; but thefe agreements, to be equitable, fhould purfue the principle of the rule here laid down. All the partners are bound by what any one of them does in the courfe of the bufinefs; for, *quoad hoc*, each partner is confidered as an authorized agent for the reft."

**PARTRIDGE**, in ornithology. See Tetrao.

The partridge is fo valuable at the table, that a great many ways of taking it have been invented by fportfmen, all of which fucceed from the natural folly and timidity of the animal.

The places partridges delight in moft are corn fields, efpecially

Partridge. eſpecially whilſt the corn grows, for under that cover they ſhelter and breed: neither are thoſe places unfrequented by them when the corn is cut down, by reaſon of the grain they find there, eſpecially in wheat ſtubble, the height of which they delight in, being to them as a covert or ſhelter. When the wheat ſtubble is much trodden by men or beaſts, they then betake themſelves to the barley ſtubble, provided it be freſh and untrodden; and they will, in the furrows, amongſt the clots, branches, and long graſs, hide both themſelves and coveys, which are ſometimes 20 in number, nay 30, in a covey.

When the winter ſeaſon is arrived, and the ſtubble fields are ploughed up, or over-ſoiled with cattle, partridges reſort into the upland meadows, and lodge in the dead graſs, or fog, under hedges, amongſt mole hills, or under the roots of trees; ſometimes they reſort to coppices and underwoods, eſpecially if any corn fields are adjacent, or where there is grown broom, brakes, fern, &c.

In the harveſt time, when every field is full of men and cattle, in the day time they are found in the fallow fields which are next adjoining to the corn fields, where they lie lurking till evening or morning, and then they feed among the ſheaves of corn.

When their haunts are known, according to the ſituation of the country and ſeaſon of the year, the next care muſt be to find them out in their haunts, which is done ſeveral ways. Some do it by the eye only; and this art can never be taught, but learned by frequent experience, the colour of the birds being ſo like that of the earth at a diſtance, that no eye but a very converſant one could diſtinguiſh them. When they are once ſeen, the buſineſs is to keep the eye upon them, and then to keep in continual motion. They are a very lazy bird, and by this means will let a perſon almoſt tread upon them; though if the perſon ſtands ſtill to eye them, they will riſe immediately though they be at a conſiderable diſtance.

Another method of diſcovering them is, by going to their haunts very early in the morning, or at the cloſe of the evening, which is called the *jucking* time. The noiſe of the cock partridge is to be attended to at this time, and is very loud and earneſt. The hen will ſoon come up to the cock after her making the noiſe, which ſhe does by way of anſwer; and when they are got together, their chattering will diſcover them. Thus they may always be found at theſe times. But there is yet a better method of finding this bird, which is by the *call*. The buſineſs, in order to have ſucceſs in this way, is carefully to learn the notes of the partridge, and be able to imitate all the ſeveral ſounds. When perfect in this, the perſon is to go to the haunts morning and evening, and placing himſelf in ſome place where he can ſee the birds without being ſeen by them, he is to liſten to their calling; and when they are heard, he is to anſwer in the ſame notes, doubling again as they do: by continuing this, they may be brought ſo near, that the perſon lying down on his back may count their whole number. Having in this manner found where the birds are, the next care is to catch them.

They are ſo fooliſh, that it is extremely eaſy to take them in *nets*. In order to this, there needs no more than the going out, provided with two or three nets, with meſhes ſomewhat ſmaller than thoſe of the pheaſant nets, and walking round about the covey, a net is to be fixed ſo as to draw over them, on pulling a line at a diſtance. All this may be eaſily done; for ſo long as the ſportſman continues moving about, and does not fix his eye too intenſely upon them, they will let him come near enough to fix the net without moving. If they lie ſo ſtraggling, that one net will not cover them, then two or three muſt be fixed in the ſame manner. The ſportſman may then draw the nets over them, and they will often lie ſtill with the nets upon them till he comes up to fright them; then they will riſe, and be entangled in the net. Partridge.

A ſecond method of taking them is with *bird lime*: this is done by means of wheat ſtraws. Theſe muſt be large, and cut off between knot and knot; they muſt be well limed with the beſt and ſtrongeſt bird lime, and the ſportſman muſt carry a great number out with him. Having found a field where there are partridges, he is to call; and if they anſwer, he is then to ſtick up the limed ſtraws in rows acroſs two or three lands, and going backward, call again to them, leading them on in the road where the ſtraws are: they will follow one another like a flock of chickens, and come out to the call; and will in their way run upon the ſtraws, and liming themſelves they will daub one another by crowding together, ſo that very few of them will be able to eſcape.

But there is yet a pleaſanter way of taking them than this, that is, by *driving* of them. In order to this, an engine is to be made of canvaſs ſtuffed with ſtraw, to repreſent a horſe; this horſe and nets are to be taken to the haunts of the partridges, and the nets being placed ſlanting or ſlopwiſe in the lower part of the field, the ſportſman is to take the wind in his back and get above them, driving them downwards; his face is to be covered with ſomething green or blue, and placing the horſe before him, he is to go towards them ſlowly and gently; and by this means they will be raiſed on their legs, but not on their wings, and will run before the horſe into the nets. If in the way they go into a wrong path, the horſe is to be moved to face them; and they will be thus driven back again, and driven every way the ſportſman pleaſes.

The partridges of Abyſſinia, we are told, are very large, being as big as *capons*.

In Jeremiah xvii. 11. we have the following curious paſſage: "As the partridge ſitteth on *eggs*, and hatcheth *them* not; ſo he that getteth riches, and not by right, ſhall leave them in the midſt of his days, and at his end ſhall be a fool;" which is explained by Mr Pool as follows: It is no wonder if we cannot be certain as to the ſenſe of theſe words, ſo far as they concern natural hiſtory, when we are not certain what bird it is to which this doth relate. We tranſlate it *partridge*: others will have it to be a *cuckoo*; but certain it is, that it is the ſame word which we tranſlate *partridge*, (1 Sam. xxvi. 20.); and cuckoos uſe not to be much hunted after. How the partridge is ſaid to ſit on eggs and hatch them not, is yet a greater queſtion. It may be occaſioned ſo many ways, viz. either ſitting upon wind eggs; or being killed before the eggs are hatched; or having its eggs deſtroyed by the male partridge, or by ſome dog or other vermine; or, its neſt being found, having her eggs taken from her, that it is hard

to

to determine which the prophet means. Of all others, I least approve of that which Jerome makes the sense, though the thing be true (if we may believe Cassiodorus and several natural historians, Aldrovandus, &c.), that partridges have such a love and desire to hatch young ones, that having lost their own eggs, they will steal the eggs of other partridges, and hatch them; which being hatched, the young ones knowing the cry of their proper dams, hearing them call, leave the partridge that hatched them (which is one thing quoted by Aldrovandus, to show the sagacity of that bird); but if this were the sense, the words would be, ' as the partridge sitteth on eggs, and hatcheth them, but enjoyeth them not;" whereas they are, ' hatcheth them not;' that is, having lost them, either by some man that hath taken them from her, or by some vermine or wild beast." *Pool's Annot. in Loc.*

The words in the original are, רגר ולא ילר קרא, which the Septuagint translate *εφωνησε περδιξ*, &c. " The partridge cried; it gathered together what it had not produced;" and some translate the Hebrew, " The partridge lays many eggs, but does not hatch them all." Le Clerc, upon the authority of Bocchart, understands the Hebrew word *kore* here to signify a *woodcock*. Le Clerc's translation is as follows: *Rusticula ova colligit, sed non parit; facit sibi divitias, sed sine jure, mediis suis diebus eas relinquit, atque ad extremum stulta est.*

PARTURITION, the art of bringing forth or being delivered of young. See MIDWIFERY.

PARTY, in a military sense, a small number of men, horse, or foot, sent upon any kind of duty; as into an enemy's country to pillage, to take prisoners, and to oblige the country to come under contribution. Parties are often sent out to view the roads and ways, get intelligence, seek forage; to reconnoitre, or amuse the enemy upon a march: they are also frequently sent upon the flanks of an army or regiment, to discover the enemy if near, and prevent surprise or ambuscade.

PARU, in natural history, the name of a very singular American fish. It is broad, flat, and rounded; not very thick, and usually of about five or six inches long, and more than four broad. It has six fins, one large and long, one on the back, and another on the belly behind the anus; each of these reaches to the tail, and has toward the end a long string or cord, made of a single filament, that on the back fin being longer than that on the belly; behind the gills it has also two fins of two fingers breadth long and one broad; and two others on the belly, which are very narrow; its head is small, and its mouth elevated and small, and furnished with small teeth; its scales are of a moderate size, and are half black and half yellow, so that the fish appears of a black colour, variegated with yellow half moons; its gills, and the beginning of its fins, are also yellow; and it has, on each side near the head, a yellow spot; it is eatable.

PARVICH, an island near Dalmatia, and one of the best peopled and most considerable of those which are under the jurisdiction of Sibenico. It contains a great number of fishermen, and a considerable number of persons who give themselves up to agriculture. It contains many Roman antiquities, which evidently show that it was a Roman station. It seems to be among the number of those islands which Pliny calls *Celadussa*, which is supposed to be an inversion of *δυσκελαδος*, which means *ill sounding* or *noisy*. Parvich is not of large extent, but it is extremely fertile. Every product succeeds in perfection there: we mean those products of which a very shallow ground is susceptible; such as wine, oil, mulberry trees, and fruit. The aspect of this island is also very pleasant at a distance, whereas that of the others adjacent disgusts the eye, by their too high, rocky, and bare hills. The name of *Parvich* seems to have been given it because it is the first one meets with on going out of the harbour of Sibenico; for the Illyric word *parvi* signifies *first*.



PARULIDES, in surgery, tumors and inflammations of the gums, commonly called *gum boils*. They are to be treated with discutients like other inflammatory tumors.

PARUS, or TITMOUSE, in ornithology, a genus belonging to the order of passeres. The bill is very entire, covered at the basis with hairs; the tongue is truncated and hairy. There are 14 species; of which the most remarkable are,

1. The cristatus, or crested titmouse, weighs 13 pennyweight; the bill is black, with a spot of the same colour above it; all the upper part of the body gray, the neck and under parts are white, with a faint tincture of red, which is deepest just below the wings. The legs are of a lead colour. It erects its crown feathers into a crest. It inhabits the warm parts of North America; and frequents forest trees, feeding upon insects.

2. The major, or great titmouse, has the head and throat black, the cheeks white, the back of a green colour, the belly yellowish green, divided in the middle by a bed of black which extends to the vent; the rump of a bluish gray, the legs of a lead colour, the toes divided to the very origin, and the back toe very large and strong. This species sometimes visits our gardens; but for the most part inhabits woods, where it builds in hollow trees, laying about ten eggs. It feeds on insects, which it finds in the bark of trees. In the spring they do a great deal of mischief by picking off the tender buds of the fruit trees. Like woodpeckers, they are perpetually running up and down the bodies of trees in quest of food. This bird has three cheerful notes, which it begins to utter in the month of February.

3. The cœruleus, or blue titmouse, is a very beautiful bird. The bill is short and dusky; the crown of the head of a fine blue; from the bill to the eyes is a black line; the forehead and cheeks white; the back of a yellowish green; the lower side of the body yellow; the wings and tail blue, the former marked transversely with a white bar; the legs of a lead colour. They frequent gardens; and do great injury to fruit trees, by bruising the tender buds in search of the insects which lie under them. It breeds in holes of walls, and lays 12 or 14 eggs.

4. The virginianus, or yellow rump, is found in Virginia; and is distinguished by a yellow spot on its rump. All the rest of the feathers are brown, with a slight tincture of green. It runs about the bodies of trees; and feeds on insects, which it pecks from the crevices of the bark.

5. The caudatus, or long-tailed titmouse, is about five inches and a quarter in length, and seven inches in breadth. The bill is black, very thick and convex,

Parus. differing from all others of this genus. The top of the head, from the bill to the hind part, is white, mixed with a few dark gray feathers: this bed of white is entirely surrounded with a broad stroke of black; which rising on each side of the upper mandible, passes over each eye, unites at the hind part of the head, and continues along the middle of the back to the rump. The feathers on each side of this black stroke are of a purplish red, as are those immediately incumbent on the tail. The tail is the longest, in proportion to the bulk, of any British bird, being in length three inches, the form not unlike that of a magpie, consisting of 12 feathers of unequal lengths, the middlemost the longest, those on each side growing gradually shorter. These birds are often seen passing through our gardens, going from one tree to another, as if in their road to some other place, never making any halt. They make their nests with great elegance, of an oval shape, and about eight inches deep, having near the upper end a hole for admission. The external materials are mosses and lichens curiously interwoven with wool. On the inside it is very warmly lined with a thick bed of feathers. The female lays from 10 to 17 eggs. The young follow their parents the whole winter; and, from the slimness of their bodies, and great length of tail, appear, while flying, like as many darts cutting the air.

6. The biarmicus, or bearded titmouse, has a short, strong, and very convex bill, of box colour; the head of a fine gray; the chin and throat white; the middle of the breast flesh coloured; the sides and thighs of a pale orange; the hind part of the neck and back of orange bay; the tail is two inches and three quarters long; the legs of a deep shining black. The female wants the flesh colour on the breast, and a triangular tuft of black feathers on each side the bill which adorn the male. They are found in marshy places.

7. The remiz, or small species of titmouse. It is called *parus pendulinus*, and is often found in Lithuania. Mr Coxe, in his Travels through Poland, gives the following account of this little animal. "The wondrous structure of its pendent nest induced me to give an engraving † of both that and the birds themselves. They are of the smallest species of titmice. The head is of a very pale bluish ash colour; the fore part of the neck and the breast tinged with red; the belly white; wings black; back and rump of a yellowish rust colour; quill feathers cinereous, with the exterior sides white; the tail rust coloured. The male is singularly distinguished from the female by a pair of black-pointed whiskers. Its nest is in the shape of a long purse, which it forms with amazing art, by interweaving down, gossamer, and minute fibres, in a close and compact manner, and then lining the inside with down alone, so as to make a snug and warm lodge for its young brood. The entrance is at the side, small, and round, with its edge more strongly marked than the rest of this curious fabric: the bird, attentive to the preservation of its eggs or little ones from noxious animals, suspends it at the lesser end to the extremity of the slender twigs of a willow or some other tree over a river. Contrary to the custom of titmice, it lays only four or five eggs: possibly Providence hath ordained this scantiness of eggs to the remiz, because by the singular instinct imparted to it, it is enabled to secure its young much more effectually from destruction, than the other species, which are very prolific."

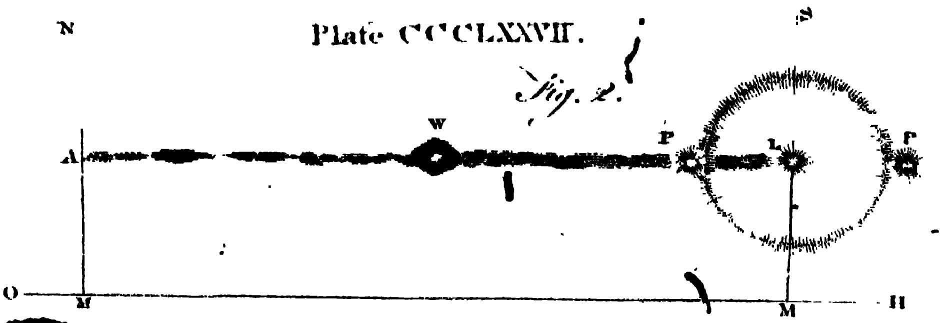
† See Plate CCCLXXVII.

Pascal. PASCAL (Blaise), one of the greatest geniuses and best writers France has produced, was born at Clermont in Auvergne, in the year 1623. His father, Stephen Pascal, born in 1588, and of an ancient family, was president of the court of aids in his province: he was a very learned man, an able mathematician, and a friend of Descartes. Having an extraordinary tenderness for this child, his only son, he quitted his office in his province, and went and settled at Paris in 1631, that he might be quite at leisure for the instruction of him; and Blaise never had any master but his father. From his infancy he gave proofs of a very extraordinary capacity: for he desired to know the reason of every thing; and when good reasons were not given him, he would seek for better; nor would he ever yield his assent but upon such as appeared to him well grounded. There was room to fear, that with such a cast of mind he would fall into free-thinking, or at least into heterodoxy; yet he was always very far from any thing of this nature.

What is told of his manner of learning the mathematics, as well as the progress he quickly made in that science, seems almost miraculous. His father, perceiving in him an extraordinary inclination to reasoning, was afraid lest the knowledge of the mathematics would hinder his learning the languages. He kept him therefore as much as he could from all notions of geometry, locked up all his books of that kind, and refrained even from speaking of it in his presence. He could not, however, make his son refrain from musing upon proportions; and one day surprised him at work with charcoal upon his chamber floor, and in the midst of figures. He asked him what he was doing? I am searching, says Pascal, for such a thing; which was just the 32d proposition of the first book of Euclid. He asked him then how he came to think of this? It was, says Pascal, because I have found out such another thing: and so going backward, and using the names of *bar* and *round*, he came at length to the definitions and axioms he had formed to himself. Does it not seem miraculous that a boy should work his way into the heart of a mathematical book, without ever having seen that or any other book upon the subject, or knowing any thing of the terms? Yet we are assured of the truth of this by Madame Perier, and several other writers, the credit of whose testimony cannot reasonably be questioned. He had, from henceforward, full liberty to indulge his genius in mathematical pursuits. He understood Euclid's Elements as soon as he cast his eyes upon them: and this was not strange; for, as we have seen, he understood them before. At 16 years of age he wrote a treatise of conic sections, which was accounted by the most learned a mighty effort of genius; and therefore it is no wonder that Descartes, who had been in Holland a long time, should, upon reading it, choose to believe that Mr Pascal the father was the real author of it. At 19, he contrived an admirable arithmetical machine, which was esteemed a very wonderful thing, and would have done credit as an invention to any man versed in science, and much more to such a youth.—About this time his health became impaired, and he was in consequence obliged to suspend his labours; nor

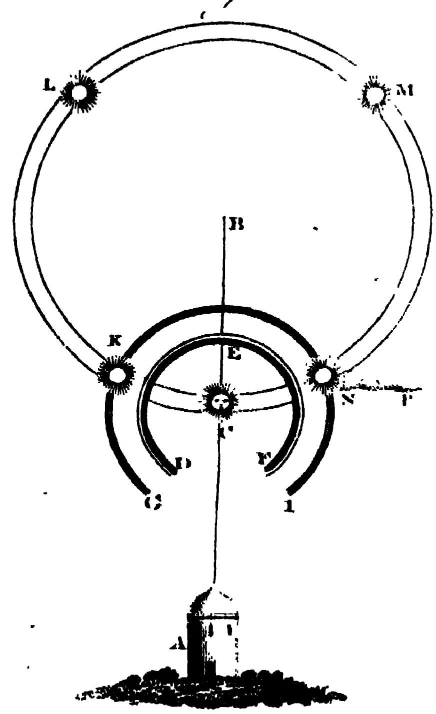
Plate CCCLXXVII.

Fig. 2.



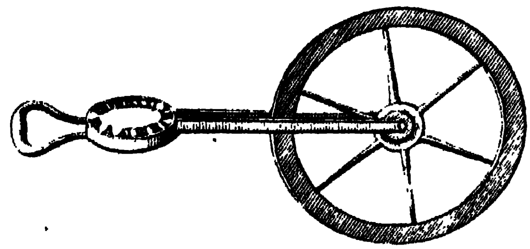

Parhelion.

Fig. 1.




Parus, or Titmouse. M & F.

Perambulator.



A. Bell Prin. Wal. Sculptor fecit

Pascal. nor was he in a condition to resume them till four years after. About that period, having seen Torricelli's experiment respecting a vacuum and the weight of the air, he turned his thoughts towards these objects; and in a conference with M. Petit, intendant of fortifications, proposed to make farther researches. In consequence of this idea, he undertook several new experiments, one of which was as follows: Having provided a glass tube, 46 feet in length, open at one end, and sealed hermetically at the other, he filled it with red wine, that he might distinguish the liquor from the tube. He then elevated it in this condition; and having placed it perpendicularly to the horizon, stopped up the bottom, and plunged it into a vessel full of water, to the depth of a foot; after which he opened the extremity of the tube, and the wine descended to the distance of about 32 feet from the surface of the vessel, leaving a considerable vacuum at the upper extremity. He next inclined the tube, and remarked that the wine rose higher; and having inclined it till the top was within 32 feet of the ground, making the wine thus run out, he found that the water rose in it, so that it was partly filled with that fluid, and partly with wine. He made also a great many experiments with siphons, syringes, bellows, and all kinds of tubes, making use of different liquors, such as quicksilver, water, wine, oil, &c.; and having published them in 1647, dispersed his work throughout all France, and transmitted it also to foreign countries. All these experiments, however, ascertained effects, without demonstrating the causes. Pascal knew that Torricelli conjectured that those phenomena which he had observed were occasioned by the weight of the air (A); and in order to discover the truth of this theory, he made an experiment at the top and bottom of a mountain in Auvergne, called *Le Puy de Dome*, the result of which gave him reason to conclude that air was weighty. Of this experiment he published an account, and sent copies of it to most of the learned men in Europe. He likewise renewed it at the top of several high towers, such as those of Notre Dame at Paris, St Jacques de la Boucherie, &c.; and always remarked the same difference in the weight of the air, at different elevations. This fully convinced him of the weight of the atmosphere; and from this discovery he drew many useful and important inferences. He composed also a large treatise, in which he thoroughly explained this subject, and replied to all the objections that had been started against it. As he thought this work rather too prolix, and as he was fond of brevity and precision, he divided it into two small treatises, one of which he entitled, A Dissertation on the Equilibrium of Liquors; and the other, An Essay on the Weight of the Atmosphere. These labours procured Pascal so much reputation, that the greatest mathematicians and philosophers of the age proposed various questions to him, and consulted him respecting such difficulties as they could not solve.—Some years after, while tormented with a violent fit of the toothach, he discovered the solution of a problem proposed by Father Mersenne, which had baffled the penetration of all those who had attempted it. This problem was to determine the curve described in the air by the nail of a coach wheel, while the machine is in motion. Pascal offered a reward of 40 pistoles to any one who should give a satisfactory answer to it. No one, however, having succeeded, he published his own at Paris; but as he began now to be disgusted with the sciences, he would not put his real name to it, but sent it abroad under that of A. d'Ettenville.—This was the last work which he published in the mathematics; his infirmities now increasing so much, that he was under the necessity of renouncing severe study, and of living so recluse, that he scarcely admitted any person to see him.

After he had thus laboured abundantly in mathematical and philosophical disquisitions, he forsook those studies and all human learning at once; and determined to know nothing, as it were, for the future, but Jesus Christ and him crucified. He was not 24 years of age, when the reading some pious books had put him upon taking this holy resolution; and he became as great a devotee as any age had produced. Mr Pascal now gave himself up entirely to a state of prayer and mortification. He had always in his thoughts these great maxims, of renouncing all pleasure and all superfluity; and this he practised with rigour even in his illnesses, to which he was frequently subject, being of a very invalid habit of body: for instance, when his sickness obliged him to feed somewhat delicately, he took great care not to relish or taste what he eat. He had no violent affection for those he loved; he thought it sinful, since a man possesses a heart which belongs only to God. He found fault with some discourses of his sister, which she thought very innocent; as if she had said upon occasion, that she had seen a beautiful woman, he would be angry, and tell her, that she might raise bad thoughts in footmen and young people. He frequently wore an iron girdle full of points next to his skin; and when any vain thought came into his head, or when he took particular pleasure in any thing, he gave himself some blows with his elbow, to redouble the prickings, and to recal himself to his duty.

Though Mr Pascal had thus abstracted himself from the world, yet he could not forbear paying some attention to what was doing in it; and he even interested himself in the contest between the Jesuits and the Jansenists. The Jesuits, though they had the popes and kings on their side, were yet decried by the people, who brought up afresh against them the assassination of Henry the Great, and all the old stories that were likely to make them odious. Pascal went farther; and by his *Lettres Provinciales* (B), published in 1656,



(A) Before this period, all those effects which are now known to be produced by the weight of the atmosphere, were attributed to Nature's abhorrence of a vacuum.

(B) The origin of these letters was this: for the sake of unbending his mind, Pascal used often to go to Port Royal des Champs, where one of his sisters had taken the veil, and where he had an opportunity of seeing the celebrated Mr. Arnaud, and several of his friends. This gentleman's dispute with the Doctors of the Sorbonne,

1656, under the name of *Louis de Montalte*, made them the subject of ridicule. "These letters (says Voltaire) may be considered as a model of eloquence and humour. The best comedies of Moliere have not more wit than the first part of these letters; and the sublimity of the latter part of them is equal to any thing in Bossuet. It is true, indeed, that the whole book was built upon a false foundation; for the extravagant notions of a few Spanish and Flemish Jesuits were artfully ascribed to the whole society. Many absurdities might likewise have been discovered among the Dominican and Franciscan casuists; but this would not have answered the purpose; for the whole raillery was to be levelled only at the Jesuits. These letters were intended to prove, that the Jesuits had formed a design to corrupt mankind; a design which no sect of society ever had, or can have." Voltaire calls Pascal the first of their satirists; for Despreaux, says he, must be considered as only the second. In another place, speaking of this work of Pascal, he says that "examples of all the various species of eloquence are to be found in it. Though it has been now written almost 100 years, yet not a single word occurs in it, favouring of that vicissitude to which living languages are so subject. Here then we are to fix the epocha when our language may be said to have assumed a settled form. The bishop of Lucon, son of the celebrated Bussy, told me, that asking one day the bishop of Meaux what work he would covet most to be the author of, supposing his own performances set aside, Bossuet replied, The Provincial Letters." These letters have been translated into all languages, and printed over and over again. Some have said, that there were decrees of formal condemnation against them; and also that Pascal himself, in his last illness, detested them, and repented of having been a Jansenist: but both these particulars are false and without foundation. Father Daniel was supposed to be the anonymous author of a piece against them, entitled, *The Dialogues of Cleander and Eudoxus.*

Pascal was only about the age of 30 when these letters were published, yet he was extremely infirm, and his disorders increasing soon after, so much that he conceived his end fast approaching, he gave up all farther thoughts of literary composition. He resolved to spend the remainder of his days in retirement and pious meditation; and with this view he broke off all his former connexions, changed his habitation, and spoke to no one, not even to his own domestics. He made his own bed, fetched his dinner from the kitchen, carried it to his apartment, and brought back the plates and dishes in the evening; so that he employed his servants only to cook for him, to go to town, and to do such other things as he could not absolutely do himself. In his chamber nothing was to be seen but two or three chairs, a table, a bed, and a few books. It had no kind of ornament whatever; he had neither a carpet on the floor nor curtains to his bed; but this did not prevent him from sometimes receiving visits; and when his friends appeared surprised to see him thus without furniture, he replied, that he had what was necessary, and that any thing else would be a superfluity, unworthy of a wise man. He employed his time in prayer, and in reading the Holy Scriptures; and he wrote down such thoughts as this exercise inspired. Though his continual infirmities obliged him to use very delicate food, and though his servants employed the utmost care to provide only what

Sorbonne, who were endeavouring to condemn his opinions, was of course frequently brought upon the carpet. Mr Arnaud, solicited to write a defence, had composed a treatise, which, however, did not meet with approbation, and which he himself considered as a very indifferent work. Pascal being one day in company, some of those present, who were sensible of his abilities, having said to him, "You who are a young man ought to do something;" he took the hint, and composed a letter, which he showed to his friends, and which was so much admired, that they insisted on its being printed. The object of this letter is an explanation of the terms, *next power*, *sufficient grace*, and *actual grace*; and the author here shows, as well as in two others which followed it, that a regard for the faith was not the motive which induced the Doctors of the Sorbonne to enter into dispute with Mr Arnaud, but a desire of oppressing him by ridiculous questions. Pascal, therefore, in other letters which he published afterwards, attacks the Jesuits, whom he believed to be the authors of this quarrel; and in the most elegant style, seasoned with wit and satire, endeavours to render them not only odious but ridiculous. For this purpose he employs the form of dialogue, and introduces an ignorant person, as men of the world generally are, who requests information respecting the questions in dispute from these Doctors, whom he consults by proposing his doubts; and his answers to their replies are so conspicuous, pertinent, and just, that the subject is illustrated in the clearest manner possible. He afterwards exposes the morality of the Jesuits, in some conversations between him and one of their casuists, in which he still represents a man of the world, who seeks for instruction, and who, hearing maxims altogether new to him, seems astonished, but still listens with moderation. The casuist believes that he is sincere, and relishes these maxims; and under this persuasion he discovers every thing to him with the greatest readiness. The other is still surprised; and as his instructor attributes this surprise only to the novelty of his maxims, he still continues to explain himself with the same confidence and freedom. This instructor is a simple kind of man, who is not overburdened with acuteness, and who insensibly engages himself in details which always become more particular. The person who listens, wishing neither to contradict him nor to subscribe to his doctrine, receives it with an ambiguous kind of raillery; which, however, sufficiently shows what opinion he entertains of it. The Jesuits reproached the author with having employed only raillery against them, and with having misrepresented several passages of their authors; which induced Pascal to write eight more in vindication of himself. All these letters, in number 18, written in a style altogether new in France, appeared in 4to, one after another, from the month of January 1656, to the month of March of the year following.

Pascal. what was excellent, he never relished what he ate, and seemed quite indifferent whether what they brought him was good or bad. When any thing new and in season was presented to him, and when he was asked, after he had finished his repast, how he liked it, he replied, "You ought to have informed me beforehand, I should have then taken notice of it." His indifference in this respect was so great, that though his taste was not vitiated, he forbade any sauce or ragout to be made for him which might excite his appetite. He took without the least repugnance all the medicines that were prescribed him for the re-establishment of his health; and when Madame Perrier, his sister, seemed astonished at it, he replied ironically, that he could not comprehend how people could ever show a dislike to a medicine, after being apprised that it was a disagreeable one, when they took it voluntarily; for violence or surprise ought only to produce that effect.

Though Pascal had now given up intense study, and though he lived in the most temperate manner, his health continued to decline rapidly; and his disorders had so enfeebled his organs, that his reason became in some measure affected. He always imagined that he saw a deep abyss on his left side, and he never would sit down till a chair was placed there, to secure him from the danger which he apprehended. His friends did every thing in their power to banish this melancholy idea from his thoughts, and to cure him of his error, but without the desired effect; for though he would become calm and composed for a little, the phantom would in a few moments again make its appearance and torment him. The cause of his seeing this singular vision for the first time, is said to have been as follows: His physicians, alarmed on account of the exhausted state to which he was reduced, had advised him to substitute easy and agreeable exercise for the fatiguing labours of the closet. One day, in the month of October 1654, having gone according to custom to take an airing on the Pont de Neuilly, in a coach and four, the two first horses suddenly took fright, opposite to a place where there was no parapet, and threw themselves violently into the Seine; but the traces luckily giving way, the carriage remained on the brink of the precipice. The shock which Pascal, in his languishing situation, must have received from this dreadful accident, may easily be imagined. It threw him into a fit, which continued for some time, and it was with great difficulty that he could be restored to his senses. After this period his brain became so deranged, that he was continually haunted by the remembrance of his danger, especially when his disorders prevented him from enjoying sleep. To the same cause was attributed a kind of vision or ecstasy that he had some time after; a memorandum of which he preserved during the remainder of his life in a bit of paper, put between the cloth and the lining of his coat, and which he always carried about him. Some of the Jesuits had the baseness and inhumanity to reproach this great genius with the derangement of his organs. In the Dictionary of Jansenist Books, he is called a *hypochondriat*, and a man of a *wrong head*, and a *bad heart*. But, as a celebrated writer has observed, Pascal's disorder had in it nothing more surprising or disgraceful than a fever, or the vertigo. During the last years of his life, in which he exhibited a melancholy example of the humiliating reverses which take place in this transitory scene, and which, if properly considered, might teach mankind not to be too proud of those abilities which a moment may take from them, he attended all the salutations (c), visited every church in which relicks were exposed, and had always a spiritual almanack, which gave an account of all those places where particular acts of devotion were performed. On this occasion it has been said, that "Religion renders great minds capable of little things, and little minds capable of great."

In company, Pascal was distinguished by the amiableness of his behaviour; by his easy, agreeable, and instructive conversation, and by great modesty. He possessed a natural kind of eloquence, which was in a manner irresistible. The arguments he employed for the most part produced the effect which he proposed; and though his abilities entitled him to assume an air of superiority, he never displayed that haughty and imperious tone which may often be observed in men of shining talents. The philosophy of this great man consisted in renouncing all pleasure, and every superfluity. He not only denied himself the most common gratifications; but he took also without reluctance, and even with pleasure, either as nourishment or as remedies, whatever was disagreeable to the senses; and he every day retrenched some part of his dress, food, or other things, which he considered as not absolutely necessary. Towards the close of his life, he employed himself wholly in pious and moral reflections, writing down those which he judged worthy of being preserved. The first piece of paper he could find was employed for this purpose; and he commonly put down only a few words of each sentence, as he wrote them merely for his own use. The bits of paper upon which he had written these thoughts, were found after his death filed upon different pieces of string, without any order or connexion; and being copied exactly as they were written, they were afterwards arranged and published.

The celebrated Bayle, speaking of this great man, says, A hundred volumes of sermons are not of so much avail as a simple account of the life of Pascal. His humility and his devotion mortified the libertines more than if they had been attacked by a dozen of missionaries. In a word, Bayle had so high an idea of this philosopher, that he calls him *a paradox in the human species*. "When we consider his character (says he), we are almost inclined to doubt that he was born of a woman, like the man mentioned by Lucretius:

"*Ut vix humana videatur stirpe creatus.*"

Mr Pascal died at Paris the 19th of August 1662, aged

(c) Certain solemn prayers, which are repeated at certain hours, and on certain days, in the Popish churches.

aged 39 years. He had been some time about a work against atheists and infidels, but did not live long enough to digest the materials he had collected. What was found among his papers was published under the title of *Pensées*, &c. or *Thoughts upon religion and other subjects*, and has been much admired. After his death appeared also two other little tracts; one of which is entitled, *The equilibrium of fluids;* and the other, *The weight of the mass of air.*

The works of Pascal were collected in five volumes 8vo, and published at the Hague, by De Tune, and at Paris by Nyon senior, in 1779. This edition of Pascal's works may be considered as the first published; at least the greater part of them were not before collected into one body; and some of them had remained only in manuscript. For this collection, the public were indebted to the Abbé Bossu, and Pascal deserved to have such an editor. "This extraordinary man (says he) inherited from nature all the powers of genius. He was a geometrician of the first rank, a profound reasoner, and a sublime and elegant writer. If we reflect, that in a very short life, oppressed by continual infirmities, he invented a curious arithmetical machine, the elements of the calculation of chances, and a method of resolving various problems respecting the cycloid; that he fixed in an irrevocable manner the wavering opinions of the learned respecting the weight of the air; that he wrote one of the completest works which exist in the French language; and that in his thoughts there are passages, the depth and beauty of which are incomparable—we shall be induced to believe, that a greater genius never existed in any age or nation. All those who had occasion to frequent his company in the ordinary commerce of the world acknowledged his superiority; but it excited no envy against him, as he was never fond of showing it. His conversation instructed, without making those who heard him sensible of their own inferiority; and he was remarkably indulgent towards the faults of others, It may be easily seen by his Provincial Letters, and by some of his other works, that he was born with a great fund of humour, which his infirmities could never entirely destroy. In company, he readily indulged in that harmless and delicate raillery which never gives offence, and which greatly tends to enliven conversation; but its principal object generally was of a moral nature. For example, ridiculing those authors who say, *My Book, my Commentary, my History*, they would do better (added he) to say *Our Book, our Commentary, our History;* since there are in them much more of other people's than their own." An elegant Latin epitaph was inscribed on his tomb.

PASCHAL, something belonging to the passover, or Easter. See Passover and Easter.

PAS-EP-A, the chief of the Lamas, particularly eminent for having invented characters for the Moguls. He was much esteemed by the Chinese, though the literati exclaimed against the manner in which the people demonstrated their affection. There is still at Pekin a *myau* or temple, built in honour of Pas-ep-a in the time of the Mogul emperors. He died in 1279.

PASIPHAE (fab. hist.), daughter of the Sun by Perseis, who married Minos king of Crete. She disgraced herself by an unnatural passion for a bull, which we are told she was enabled to gratify by means of the artist Dædalus. This celebrated bull had been given to Minos by Neptune, to be offered on his altars. But as the monarch refused to sacrifice the animal on account of his beauty, the god revenged his disobedience by inspiring Pasiphaë with an unnatural love for him. This fable, which is universally believed by the poets, who observe, that the Minotaur was the fruit of this infamous commerce, is refuted by some writers: who suppose that the infidelity of Pasiphaë to her husband was betrayed in her affection for an officer of the name of Taurus, and that Dædalus, by permitting his house to be the asylum of the two lovers, was looked upon as accessory to the gratification of Pasiphaë's lust. From this amour with Taurus, as it is farther remarked, the queen became mother of twins; and the name of *Minotaurus* arises from the resemblance of the children to the husband and the lover of Pasiphaë. Minos had four sons by Pasiphaë, Castreus, Deucalion, Glaucus and Androgeus; and three daughters, Hecate, Ariadne, and Phædra.



PASQUIN, a mutilated statue at Rome, in a corner of the palace of the Ursini. It takes its name from a cobler of that city called *Pasquin*, famous for his sneers and gibes, and who diverted himself by passing his jokes on all that went through that street. After his death, as they were digging up the pavement before his door, they found in the earth the statue of an ancient gladiator, well cut, but maimed and half-spoiled: this they set up in the place where it was found, and by common consent named it *Pasquin*. Since that time all satires are attributed to that figure; and are either put into its mouth, or pasted upon it, as if they were written by Pasquin redivivus; and these are addressed by Pasquin to Marforio, another statue at Rome. When Marforio is attacked, Pasquin comes to his assistance; and, when Pasquin is attacked, Marforio assists him in his turn; that is, the people make the statues speak just what they please.

PASQUINADE, a satirical libel fastened to the statue of Pasquin: these are commonly short, witty, and pointed; and from hence the term has been applied to all lampoons of the same cast.

PASS, or Passade, in fencing, an advance or leap forward upon the enemy. Of these there are several kinds; as passes within, above, beneath, to the right, the left, and passes under the line, &c. The measure of the pass is when the swords are so near as that they may touch one another.

Pass, in a military sense, a strait and difficult passage, which shuts up the entrance into a country.

*Pass Parole*, in military affairs, a command given at the head of an army, and thence communicated to the rear, by passing it from mouth to mouth.

PASSADE, in the manege, is a turn or course of a horse backwards or forwards on the same spot of ground. Hence there are several sorts of passades, according to the different ways of turning, in order to part or return upon the same tread, which is called *closing the passade;* as the passade of one time, the passade of five times, and the raised or high passades, into which the demivolts are made into curvets. See Horsemanship.

*North-west Passage*, } See *North-West Passage, North-*
*North-east Passage.* } *East Passage*, and Pole.

*Right of* PASSAGE, in commerce, is an impoſition or duty exacted by ſome princes, either by land or ſea in certain cloſe and narrow places in their territories on all veſſels and carriages, and even ſometimes on perſons or paſſengers, coming in or going out of ports, &c. The moſt celebrated paſſage of this kind in Europe is the Sound: the dues for paſſing which ſtrait belong to the king of Denmark, and are paid at Elſinore or Cronenburgh.

PASSANT, in heraldry, a term applied to a lion or other animal in a ſhield, appearing to walk leiſurely; for moſt beaſts, except lions, the *trippant* is frequently uſed inſtead of *paſſant*.

PASSAU, an ancient, handſome, and celebrated town of Germany, in Lower Bavaria, with a biſhop's ſee and fort. The houſes are well built, and the cathedral is thought to be the fineſt in all Germany. It is divided into four parts, three of which are fortified; but the other is only a ſuburb, and has nothing but an old caſtle in which the biſhop generally reſides. It is ſeated at the confluence of the rivers Inn and Iltz, in E. Long. 13. 34. N. Lat. 48. 26.

PASSAU, a biſhopric of Germany, lying between Lower Bavaria, Auſtria, and Bohemia. It extends not above 20 miles where largeſt; and has no conſiderable place, except the capital, which is of the ſame name.

PASSERAT (John), a celebrated profeſſor of eloquence in the royal college of Paris, and one of the politeſt writers of his time, was born at Troyes, in the province of Champagne, in 1534. He ſpent three years in ſtudying the law under the famous Cujacius at Bourges, where he became profeſſor of eloquence in 1572. He was an indefatigable ſtudent, paſſing frequently whole days without eating a morſel; yet to an extraordinary erudition he joined an uncommon politeneſs of manners and pleaſantry, having nothing of the mere ſcholar except the gown and hood. He gained the eſteem of the kings Charles IX. Henry III. and of all the men of wit and learning in his time. He died in 1602, and left ſeveral admired works behind him.

PASSERES, the name of a claſs of birds. See ZOOLOGY.

END OF THE THIRTEENTH VOLUME.

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